



NEW High-Speed, Multi-Camera
Machine Vision System
CV-X200/X100 Series

POWER MEETS SIMPLICITY



GLOBAL STANDARD

DIGEST VERSION

CV-X200/X100 Series **Ver.3**

THE EVOLUTION OF KEYENCE MACHINE VISION SYSTEMS

KEYENCE has been an innovative leader in the machine vision field for more than 30 years. Its high-speed and high-performance machine vision systems have been continuously improved upon allowing for even greater usability and stability when solving today's most difficult applications.

In 2008, the XG-7000 Series was released as a "high-performance image processing system that solves every challenge",

followed by the CV-X100 Series as an "image processing system with the ultimate usability" in 2012.

And in 2013, an "inline 3D inspection image processing system" was added to our lineup. In this way, KEYENCE has continued to develop next-generation image processing systems based on our accumulated state-of-the-art technologies.

KEYENCE is committed to introducing new cutting-edge products that go beyond the expectations of its customers.

THE FIRST IMAGE
PROCESSING SENSOR

VX Series



CV-100/300 Series



CV-500/700 Series



XV-1000 Series



CV-2000 Series



CV-3000 Series



CV-5000 Series

FIRST PHASE *1980s to 2002*

At a time when image processors were expensive and difficult to handle, KEYENCE started development of image processors in preparation for releasing a general-purpose image processing sensor. The CV-100 Series was released as the industry's first low-cost image processing sensor.

Released the CV-300 Series using a color camera, followed by the CV-500/700 Series compact image processing sensors with integrated monitors. KEYENCE had expanded the image processing sensor market and gradually established its position in the market.

SECOND PHASE *2003 to 2007*

Released the CV-2000 Series compatible with x2 speed digital cameras and added first-in-class 2 mega-pixel CCD cameras to the lineup.

Released the CV-3000 Series that can simultaneously accept up to four cameras of eight different types, including monochrome and color. Released the CV-5000 Series that features a 5 mega-pixel camera, highest in its class, and several new algorithms.

Performance

Highest problem solving capability through flexibility.

XG-8000/7000 Series



Usability

Stable, long-term operation with an intuitive, user-friendly interface.

CV-X200/X100 Series



Cost

Presence detection at a reasonable cost.

IV Series



Various lens and lighting options are also available

THIRD PHASE *2008 and beyond*

Released the XG-7000 Series featuring faster performance through distributed processing, a wide variety of flexible inspection tools, and a user-customizable interface. This Series has become the standard system for solving any challenge.

Released the global standard CV-X100 Series that supports 10 languages and achieves powerful problem-solving performance through an intuitive, user-friendly programming interface. Released the IV Series vision sensor which enables easy image discrimination.

KEYENCE started supporting connection of 21 mega-pixel cameras, line scan cameras, 3D cameras, and laser profile measurement systems. In-line height measurement and various other inspections are now possible with the XG-8000/CV-X200 Series.

THREE FEATURES TO SUPPORT THE GLOBAL STANDARD

- **Easy to use, state-of-the-art algorithms.**
- **Quick, intuitive set-up and long-term stability.**
- **A wide variety of cameras and lasers to match any application.**

For high-performance image processing, ease of initial set-up, stable operation, and low-maintenance performance are essential.

Based on KEYENCE's expertise accumulated over many years, the CV-X has converted these important factors into functions easily handled by any user.

Version 3 offers even higher problem-solving performance with the addition of a 21 mega-pixel camera, a high-speed, high-capacity controller, and 3D laser-profile measurement support.

All of these functions are now possible with the same ease-of-use.

In order to provide a wide variety of choices suited for every challenge and to ensure stable operation at every production site, the CV-X Series will continue to evolve.

CV-X200/X100 Series **Ver.3**



AVAILABLE HARDWARE AND SOFTWARE → P.8

**Seven types of controllers available
depending on processing speed and capacity**

NEW

MULTI-CORE DSP-INTEGRATED
CV-X200 Series



**3D profile measurement is possible
with support of LJ-V connection**

NEW

CONNECTION-COMPLIANT
LJ-V



**16 types of cameras available
to match any application**

NEW

ULTRA HIGH-RESOLUTION
21M PIXEL CAMERA

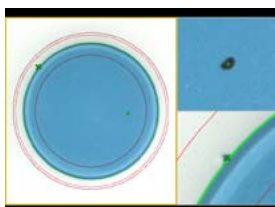
**16x21MEGA
DIGITAL**



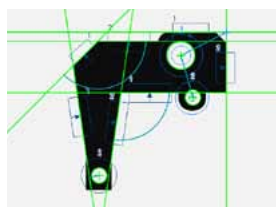
7 LJ-V laser heads available for 3D profiling



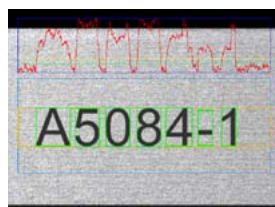
ALGORITHMS THAT ADDRESS EVERY INSPECTION REQUIREMENT → P.12



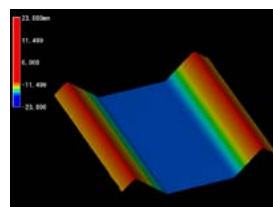
Appearance inspection



Dimension inspection



Character recognition



3D measurement

Multiple algorithms are provided to address various inspection requirements such as appearance inspection, 3D dimensional measurement, and character recognition. Based upon many years of laser measurement and machine vision experience, KEYENCE algorithms continue to evolve to support stable, in-line inspection solutions.

POWERFUL UTILITIES THAT SUPPORT STABLE OPERATION → P.24



Operation screen catalog

Users can easily create operation screens for improved visualization and custom menus that show only items preselected for frequent changes, allowing anyone to easily make required adjustments.



Camera installation replication



User manual auto-generator

Various utilities are provided to help long-term stable image processing, including functions for replicating original camera location and conditions, protecting program setting, and creating custom operator manuals automatically.

CAMERAS AND LASERS SELECTABLE TO MATCH INSPECTION TYPE

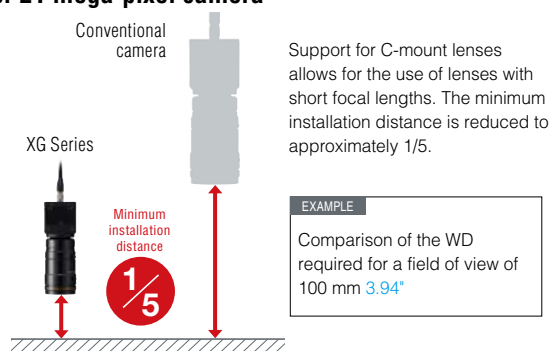
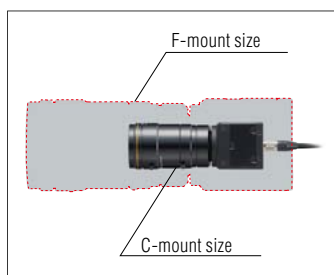
A total of 16 types of area cameras and 7 laser heads for 3D profile measurement can be connecting according to line-speed, installation space, and inspection target requirements.

An ultra high-resolution 21M pixel camera has been newly added to our conventional lineup offering optimal pixel count, size, and transfer time for each inspection item. 3D profile measurement is now possible by utilizing the LJ-V in-line profile measurement system as a measuring head. With these much expanded choices, all on-site challenges have a solution.



	NEW 21M pixel camera	5M pixel camera	2M pixel camera Series			0.31M pixel camera Series			Laser profile measurement system
	16x 21MEGA DIGITAL	11x 5MEGA DIGITAL	7x MEGA DIGITAL	MEGA DIGITAL	SUPER-SMALL DIGITAL	7x HI-SPEED DIGITAL	HI-SPEED DIGITAL	ULTRA-SMALL DIGITAL	
Model	CA-H2100M CA-H2100C	CV-H500M CV-H500C	CV-H200M CV-H200C	CV-200M CV-200C	CV-S200M CV-S200C	CV-H035M CV-H035C	CV-035M CV-035C	CV-S035M CV-S035C	LJ-V Series
Specs	×16 speed monochrome ×16 speed color	×11 speed monochrome ×11 speed color	×7 speed monochrome ×7 speed color	Monochrome Color	Compact monochrome Compact color	×7 speed monochrome ×7 speed color	Monochrome Color	Compact monochrome Compact color	Head: 7 types
Capture range	5104 × 4092 pixels	2432 × 2050 pixels	1600 × 1200 pixels	1600 × 1200 pixels	1600 × 1200 pixels	640 × 480 pixels	640 × 480 pixels	640 × 480 pixels	Z-axis: ±2.3 to ±145 mm ±0.09" to ±5.71" X-axis: 7 to 180 mm 0.28" to 7.09"
Transfer time	109.9 ms	61.2 ms	29.2 ms	58.5 ms	58.5 ms	4.7 ms	16.0 ms	16.0 ms	64000 profiles/sec

4/3" CMOS sensor, C-mount lens support for 21 mega-pixel camera



NEW

The LJ-V Series that features ultra high-speed sampling at 64 KHz can be connected as a measuring head

3D profiles of various targets can be measured while moving at high speed

High-Speed, Multi-Camera
Machine Vision System
CV-X200 Series

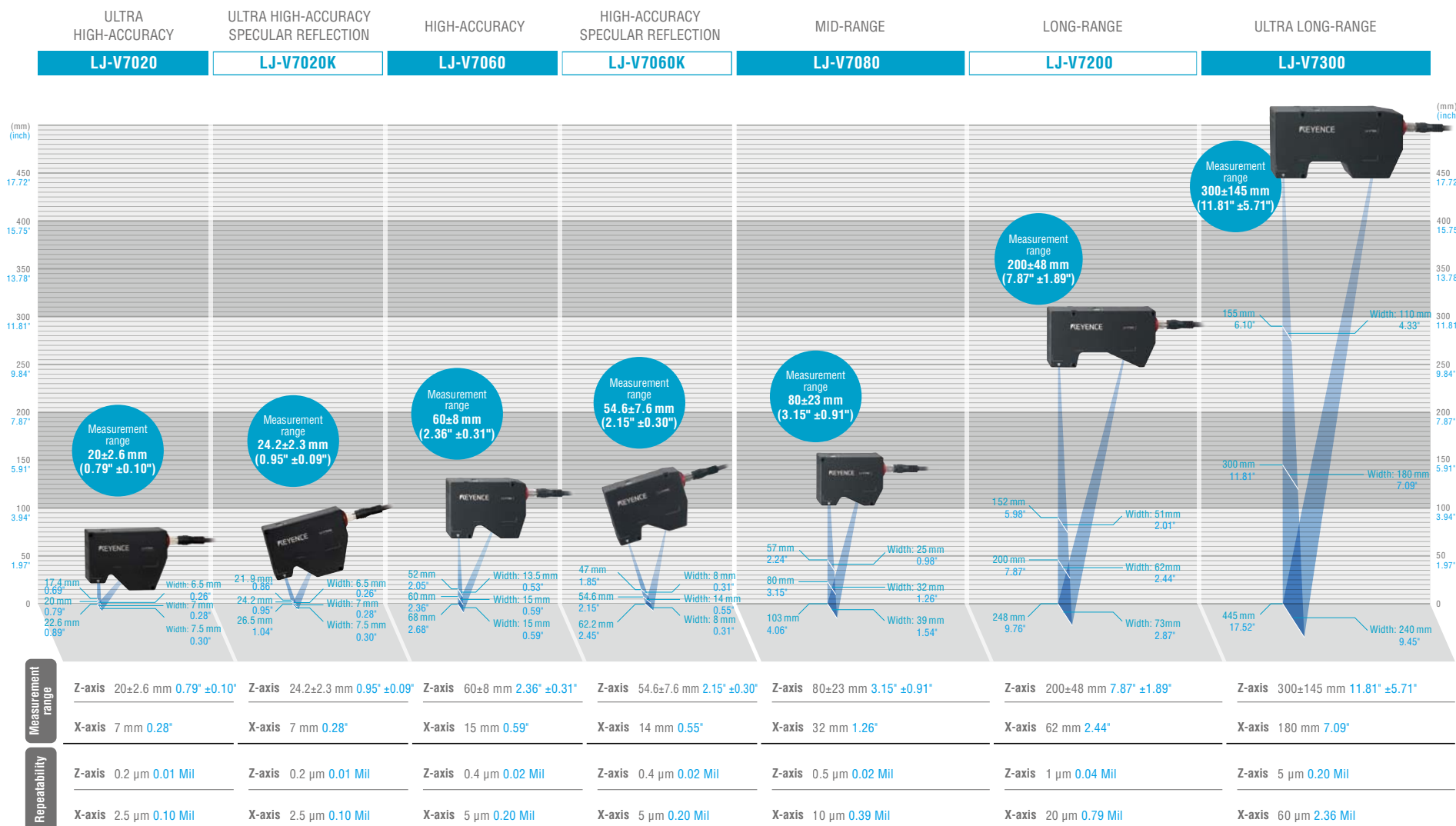
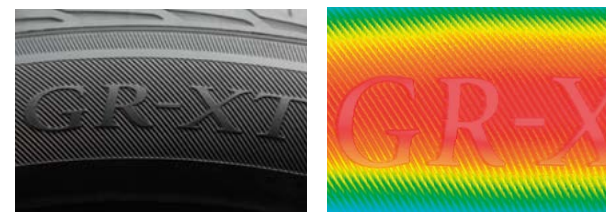


+ High-speed 2D/3D Laser Scanner
LJ-V Series

SAMPLING AT 64,000 PROFILES/SEC. WORLD'S FASTEST!

The LJ-V Series has realized the fastest sampling speed in the world for 2D laser measuring instruments.* This makes it possible to measure, in high-definition, the profiles of products on manufacturing lines being fed past the laser at extremely high speed without missing a single one. For example, the LJ-V Series can measure targets moving at 6.4 m **21.0"/s** with a 0.1 mm **0.004"** pitch. The LJ-V Series does not miss a single abnormal or defective part.

* According to KEYENCE's investigation (as of June 2013)



MULTI-CAMERA, SIMULTANEOUS IMAGE ACQUISITION SYSTEM

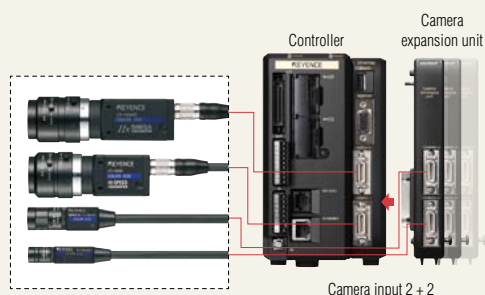


A total of 16 types of cameras can be mixed for use. For example, it is possible to attach a monochrome camera and a color camera to 1 controller unit. Also, by connecting a camera expansion unit, it is possible to connect up to two 21M pixel cameras, four 5M pixel or lower cameras*, 4 laser heads, or 2 laser head plus 2 area cameras. Because simultaneous image acquisition and simultaneous processing can be performed for all camera combinations, this system has the flexibility to support future additions and changes to inspection specifications.

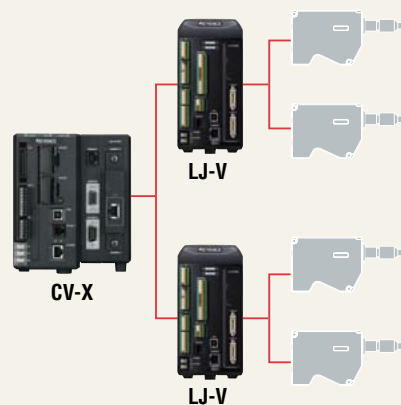
(*The expansion unit can be connected to the CV-X252F/CV-X272F/CV-X292F/CV-X152x/CV-X172x)

MULTI-CAMERA SYSTEM

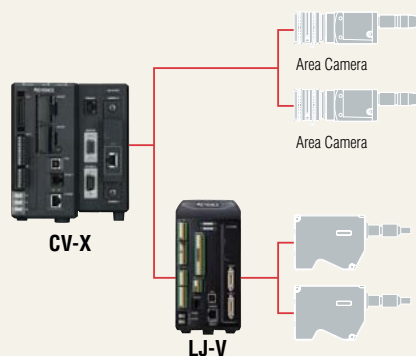
Connect up to 4 cameras from a selection of 16 cameras



CAN BE CONNECTED WITH UP TO FOUR LASER HEADS



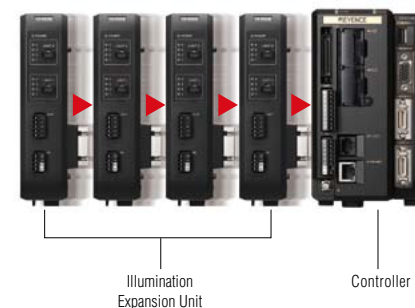
CAN ALSO BE CONNECTED WITH TWO LASER HEADS AND TWO AREA CAMERAS



ILLUMINATION EXPANSION UNIT

EASY LIGHT CONTROL WITHOUT CUMBERSOME WIRING

Up to 4 lighting expansion modules can be connected to the main controller. Each unit has 2 lighting connections (connector and terminal style) so up to eight 12 or 24 VDC lights can be connected.



Problems with conventional methods: PLC control via a number of I/O is necessary



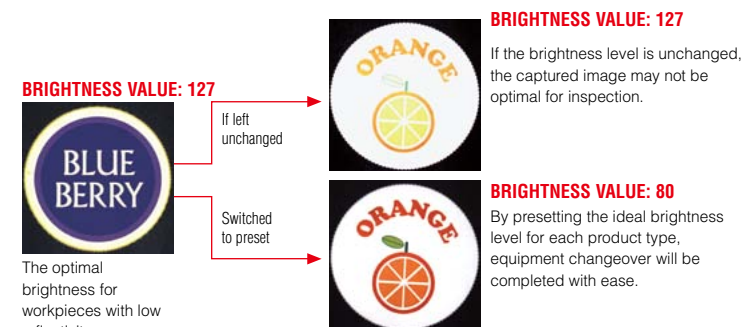
I/O unnecessary, and PLC settings are unnecessary!

APPLICATION EXAMPLE

BRIGHTNESS PRESETS FOR EACH INSPECTION SETTING

AUTOMATIC LIGHT INTENSITY ADJUSTMENT FOR EACH PRODUCT TYPE

When the product being inspected changes, different lighting settings may be required to capture the optimum image. It is possible to automatically change to the light intensity when a different product is inspected.



MULTIPLE CONTROLLERS AVAILABLE WITH THE SAME EASE-OF-USE

Selectable according to application, processing speed, capacity, and camera choice, with a Fan-less, HDD-less design

Our lineup includes seven types of controllers available according to the number and types of cameras to be connected and processing speed. It is no longer necessary to use multiple devices with different functionality for each inspection category.

In addition, the new hardware does not use components with limited life such as fans and HDDs resulting in long-term, stable operation even under harsh factory automation environments.



**ALL MODELS ARE
FAN-LESS AND
HDD-LESS**



Fan-less



HDD-less

CV-X100 Series



Standard model

NEW CV-X200 Series



High-speed, high-capacity model

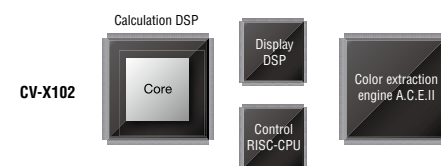
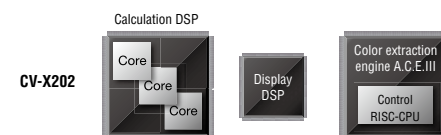


High-performance model

Model		CV-X102	CV-X152	CV-X172	CV-X202	CV-X252	CV-X272	CV-X292
Main image processor		DSP			Multi-core DSP			
Max. no. of connectable cameras		Standard	Medium	High-Speed	Standard	Medium	High-Speed	High-Speed
Supported cameras	0.31M pixel	✓	✓	✓	✓	✓	✓	✓
	1M pixel	—	✓	✓	—	✓	✓	✓
	2M pixel	—	✓	✓	—	✓	✓	✓
	5M pixel	—	—	✓	—	—	✓	✓
	21M pixel	—	—	—	—	—	—	✓
	LJ-V	—	—	—	—	—	—	✓

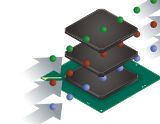
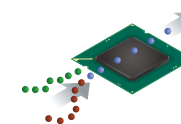
NEW Multi-core DSP-integrated CV-X200 Series

Among "3 + 1" processors that achieve ultra high-speed processing, the main DSP now has multiple cores. Even when using a 21M pixel camera or during high-load image processing, distributed processing with multiple cores allows for high-speed inspection.



SINGLE-CORE

MULTI-CORE



3D INSPECTION NEW

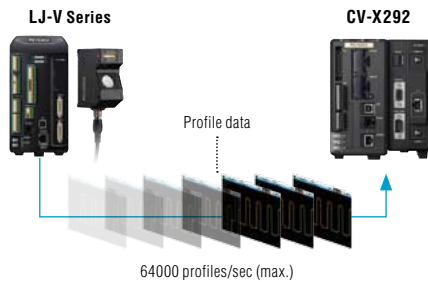
3D makes the impossible possible

3D measurement using height data is now supported, including height, area, and volume measurement. Using the height extraction function, 3D data can be converted into a gray-scale image based off the selected height range. By applying an existing image processing algorithm to this image, inspection that has been difficult with an area camera is now made possible.



Ultra high-speed 3D shape measurement using light-section method

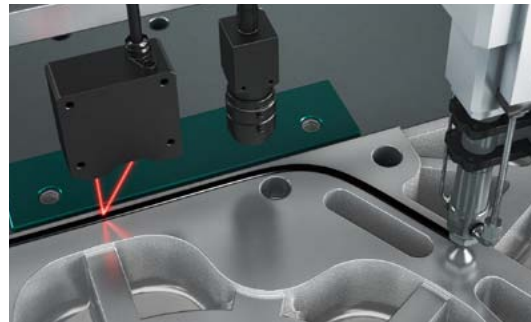
3D shapes of various targets can be measured while moving at high speed using the LJ-V Series, in-line profile measurement system featuring ultra high-speed sampling at 64 kHz.



Conventional method: laser displacement sensor + area camera

Conventional camera + displacement sensor

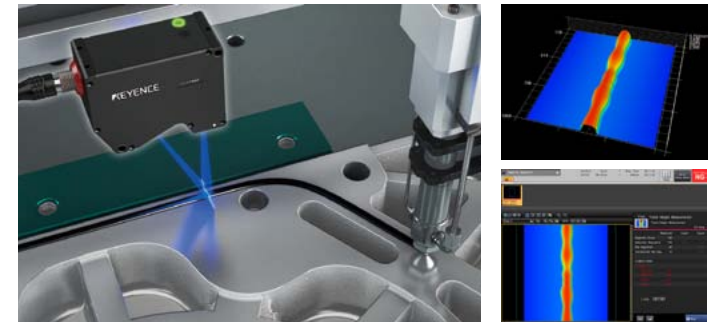
Inspects heights with a laser displacement sensor and widths and positions with a camera. This requires adjustment of installation conditions on each device and does not synchronize data between the two devices, making volumes and cross-sections difficult to calculate.



3D IMAGE PROCESSING

LJ-V + CV-X292

Height, width, position, cross-sectional area, and volume can all be inspected in one system. Target displacement can also be corrected in real time.



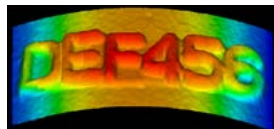
Low contrast between target and background? - Problem solved!

OCR FOR STAMPING ON A CAST COMPONENT

With an area camera, stable character recognition is difficult due to variations in background conditions and poorly defined stamped edges. Using 3D height information, the background can be distinguished clearly from characters.



Workpiece photo



Height image



Height extracted image + OCR tool

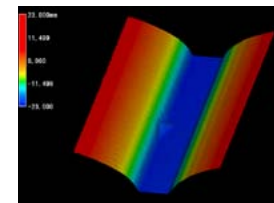
Defects missed on curved surfaces? - Problem solved!

FLAW/DENT INSPECTION FOR A PLASTIC MOLD

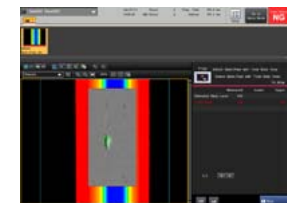
With an area camera, dents cannot be detected due to shading caused by complicated curved surfaces or concaved/convex shapes. Such detection becomes possible by extracting height deviation from free-form plane information.



Workpiece photo



Height image

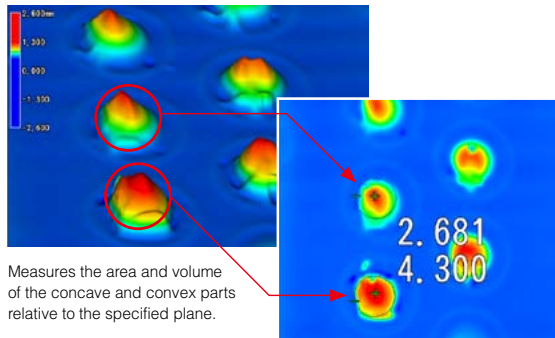


Height extracted image + stain tool

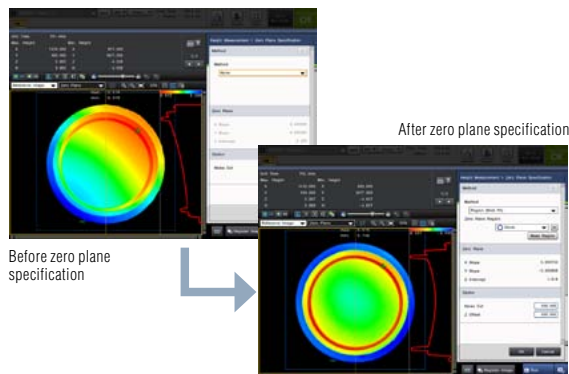
HEIGHT MEASUREMENT TOOL

Measures dimensions such as minimum/maximum heights, convex/concave areas and volumes based on 3D data. Flexible measurement is ensured by specifying any plane within the screen as a zero plane.

Area/volume measurement



Zero plane specification



Since a zero plane can be specified as a reference for height measurement, stable measurement is ensured, even if the targets change orientation.

TREND HEIGHT MEASUREMENT TOOL

Executes multiple height measurements across one region. It is possible to find the maximum/minimum values and to calculate the best-fit circle or plane among the peak values calculated for each small cross-sections of the main region.

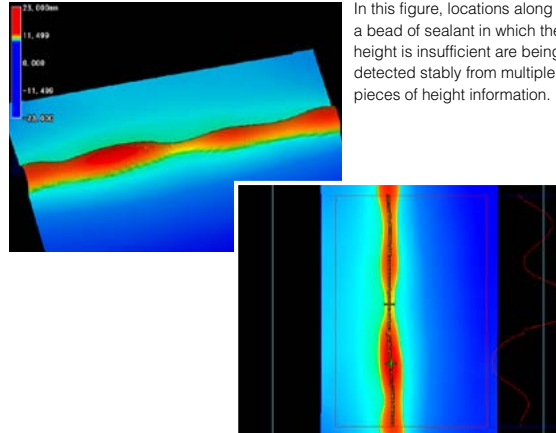
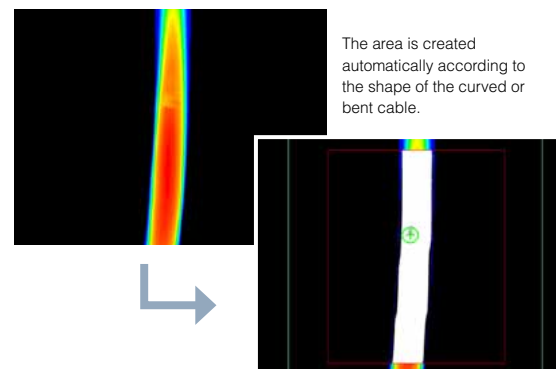


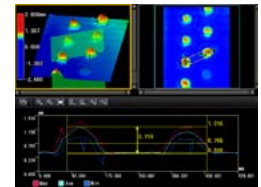
IMAGE REGION GENERATOR

Converts the specified height range into an inspection region. Even if a workpiece changes in shape, inspection will automatically occur only on surfaces within the defined height range.



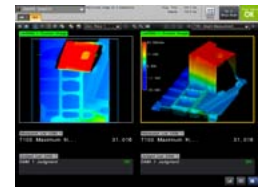
3D OBSERVATION

On a captured 3D image, a 2D profile can be displayed between any two points by specifying them with the mouse. This allows the user to verify the inspection range and settings instantaneously.



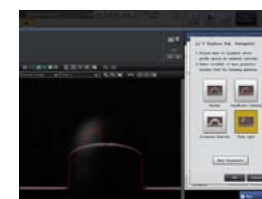
CONTROLLER 3D DISPLAY

For improved visualization, a 3D image can be displayed as an operation screen or together with processed images in a multi-screen display.

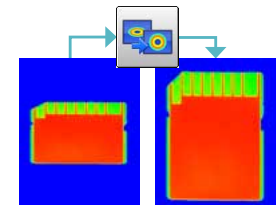


LJ-V CAPTURE OPTIONS

LJ-V parameters can be set directly in the CV-X program and optimized according to the workpiece by simply following a step-by-step process.



Navigation to the optimum settings

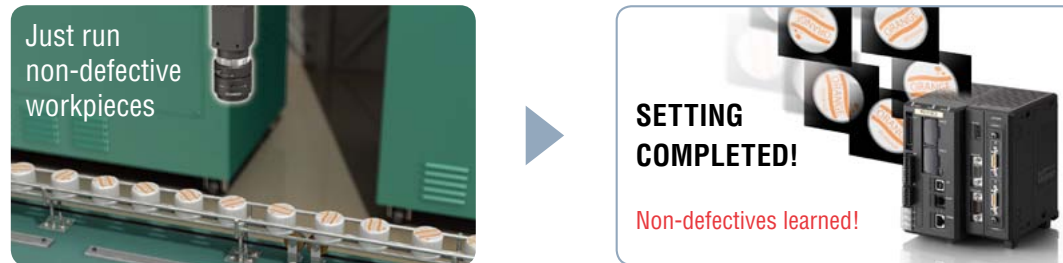


Vertical-horizontal ratio adjustment tool

AUTO-TEACH INSPECTION TOOL COLOR


An inspection tool that learns what a good part is.
Just running non-defective workpieces completes the application setup

The newly incorporated Auto-Teach Inspection Tool uses the camera to learn variations and individual differences that exist in the non-defective workpieces and recognizes workpieces that differ from these as defective workpieces. These algorithms eliminate unstable elements to successfully guide on-site inspection. Settings are performed just by running non-defective workpieces, and eliminates the conventional need for highly experienced vision integrators and complicated programming. This is an inspection tool that makes it possible for anyone to achieve and maintain a stable inspection.




NEW ALGORITHM!


Parts that are different from the learned good parts are detected as **bad!**




✓ Non-defective



✗ Different type

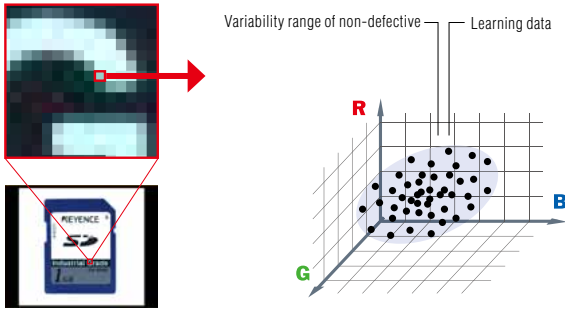


✗ Incomplete printing



✗ Flaw

Defectives not expected at the time of setting can also be detected.



LEARNING FULL COLOR INFORMATION

The variability range of the non-defective workpieces is determined by learning the full color information for each pixel to detect defects that could never be detected with a monochrome inspection while allowing for normal color variations among non-defective parts.

HELPFUL IN REALIZING EASY OPERATION

CUT INCORRECT LEARNING FUNCTION

Defective workpieces are automatically excluded, even if they are mixed-in during auto-teach eliminating the potential for human error.


SET AUTO-THRESHOLD FUNCTION

Automatically calculates and sets threshold values from the learned non-defective workpieces.

IDEAL FOR THE FOLLOWING APPLICATIONS

1. Frequent programming is required due to many product types

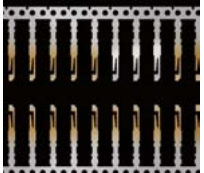
Misarrangement inspection for boxes of tissues



Setting is completed just by running non-defective workpieces. A wide variety of product type elements, including color, shape, and pattern can be handled with a single tool.

2. There are many points to inspect

Plating defect inspection for lead frames



Defect inspection with many points to inspect and generally requiring a long time for programming can be covered by a single Auto-Teach Inspection Tool.

3. Complex shapes to inspect


Flaw inspection for connector housings



Since this tool learns the entire workpiece including the profile, you do not have to set multiple inspection regions to line up with the different surfaces on a complex work surface.

4. Variable non-defectives

Assembly defect inspection for instrument panel buttons

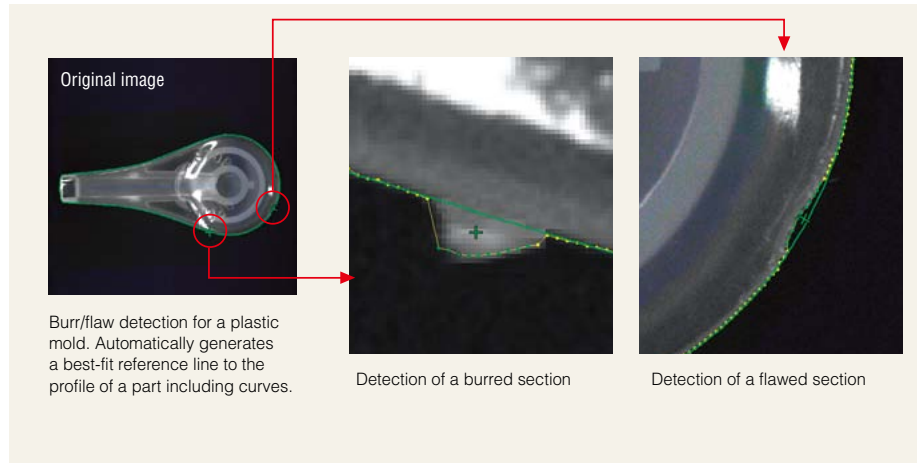


This tool learns and inspects variations such as different thicknesses caused by different lighting conditions, which can occur for non-defective workpieces. This prevents non-defective workpieces from being rejected mistakenly.

TREND EDGE STAIN

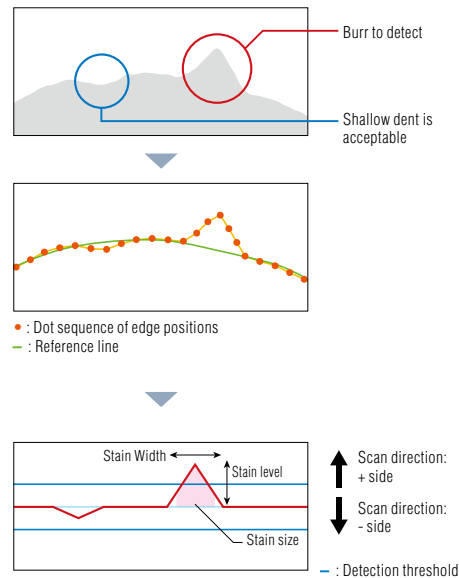
Edge defect inspection tool optimized for burr and flaw inspection

This tool extracts a profile from the edges of a workpiece and recognizes the sections that show a large difference from the profile such as burrs or flaws. In addition to circles and straight lines, ovals and profiles with complex shapes consisting of free curves are supported, based on edge information of up to 5000 points.



Applicable to various stains

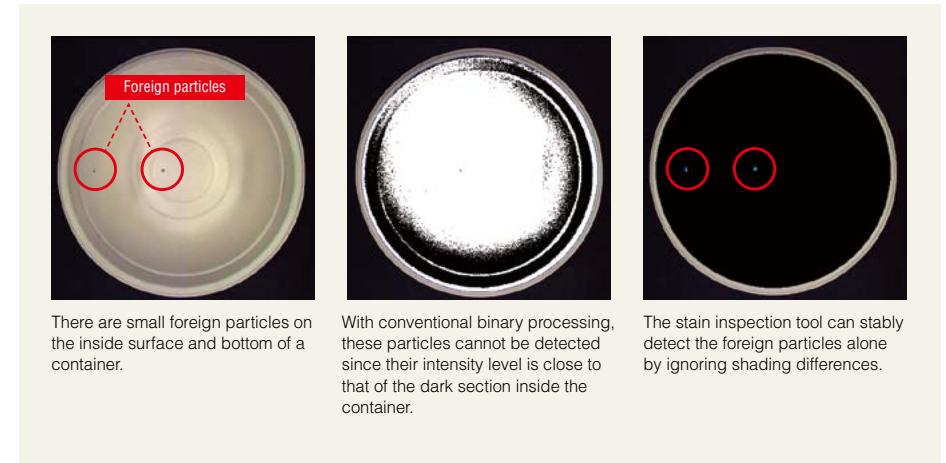
With a variety of parameters, certain defects can be distinguish from others. Settings can be optimized according to inspection category, such as +/- from the reference line (burrs/flaws) and width/size that exceeds a threshold.



STAIN

Powerful & flexible appearance inspection tool

This tool detects stains, flaws and other defects by comparing them against the surrounding shading level. In addition to excellent detection ability, the tool also features a function to only identify defects that you want to detect, by size, density, shape, and count.

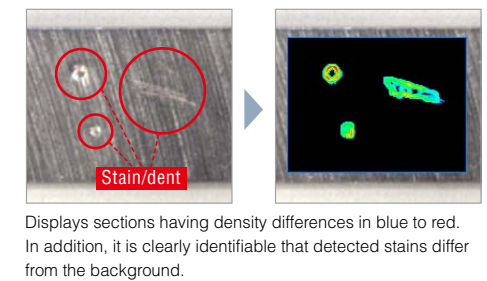


Contrast image

This function displays levels of defects with different colors depending on the intensity differences from surrounding areas. You can check visually and intuitively how different the areas you really want to detect are from the background and noise.

Since the contrast image can be checked not only during programming, but also during operation. This can be utilized effectively in various scenarios, such as investigating the cause of a false reject.

Stain detection for a metal plate



Relationship between contrast image colors and stain levels

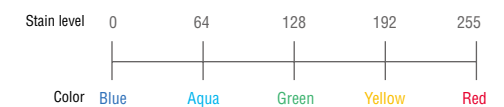


IMAGE ENHANCE FILTERS

24 types of image enhancement filters are provided to significantly compensate for changes in inspection conditions caused by workpiece conditions and external environments. KEYENCE's original algorithms generate optimal images for inspection to improve stability and reduce scrapping of non-defective workpieces due to inspection error.

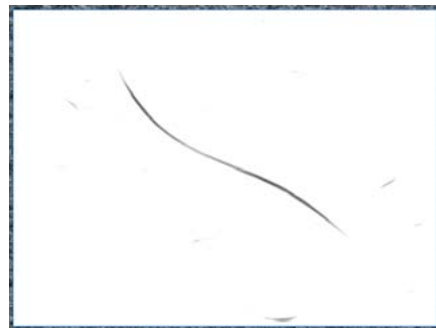
SCRATCH DEFECT EXTRACTION NEW

Eliminates noise information within the inspection region and only highlights linear information. This filter is particularly effective for linear defect inspection for workpieces having rough surface conditions.

LINEAR STAIN ON A METAL COMPONENT



A linear stain cannot be detected due to minute rough edges on the background.

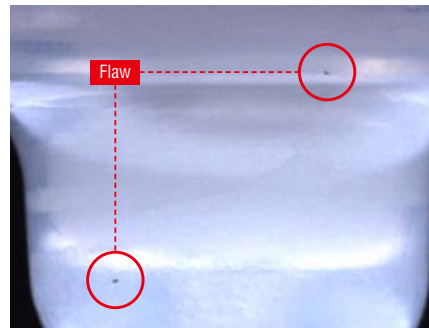


Only linear stains are extracted by ignoring background noise.

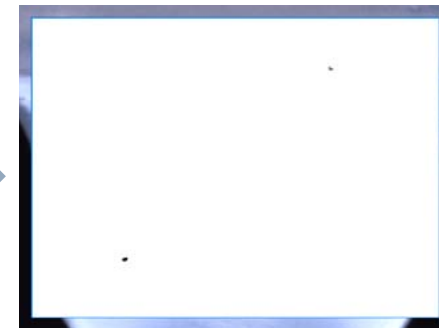
SHADING CORRECTION

Cancels shading or uneven brightness occurring on the workpiece surface to optimize images for inspection. Even if shading conditions change every time, this filter corrects images in real time to only extract defective sections.

APPEARANCE INSPECTION FOR A PLASTIC MOLD



Shading occurs on the workpiece surface due to the shape consisting of curves.

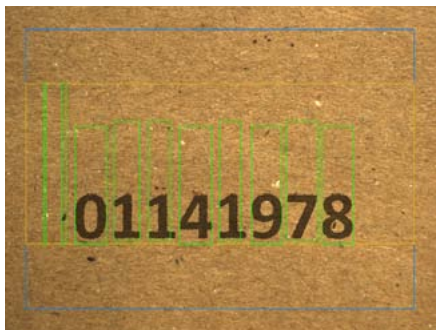


Only stains are extracted by cancelling random shading in real time.

NOISE ISOLATION NEW

Eliminates or extracts noise having a specified area or smaller. This filter is effective for ignoring a rough background that hinders image processing or for extracting subtle defects for easier detections.

RECOGNITION OF CHARACTERS PRINTED ON CARDBOARD



Characters cannot be extracted properly due to white and black fibers contained in the cardboard.



Only bright and dark noise are removed and the printing condition remains unaffected.

STAIN INSPECTION FOR A PLASTIC MOLD



Minute flaws and irregularities exist on the background and the surface with printed characters.



Only black stains smaller than the specified area are extracted.

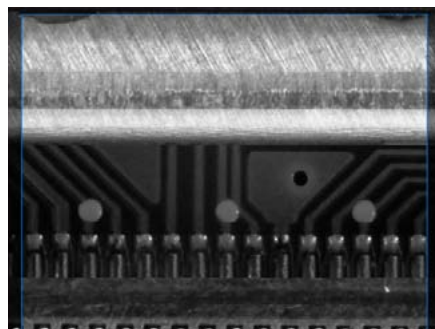
CONTRAST EXPANSION NEW

Expands the density distribution within the inspection region to increase the contrast of an image. This filter stabilizes inspection when gradation necessary for image processing cannot be obtained due to the reflectance of workpieces.

VARIOUS CIRCUIT BOARD PATTERN INSPECTIONS



The location is at the back of the workpiece, so the light intensity is insufficient, which makes it impossible to recognize the circuit board pattern.

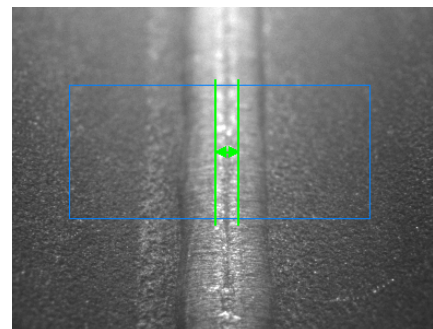


The circuit board pattern can be recognized clearly. Because the filter determines the expansion width from the density distribution within the inspection region, images without overexposure and underexposure can be captured.

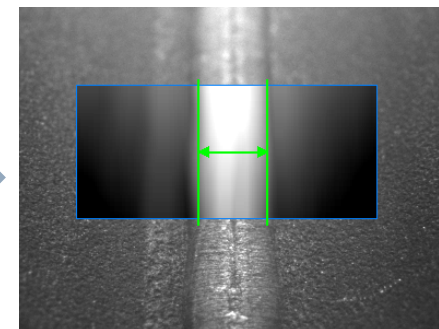
BLUR

Blurs the inspection region to remove a significant amount of fine background patterns or noise. This filter offers more stable inspection by intentionally blurring images to eliminate aspects that need not be inspected.

WIDTH INSPECTION FOR A WELDED PIPE SECTION



Edges are detected in areas outside the welded section due to hairlines on the metal surface or sputter deposited on surrounding areas.



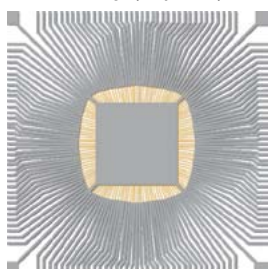
The blur filter allows for stable width measurement by eliminating unnecessary featured points other than the welded section.

SUBTRACTION

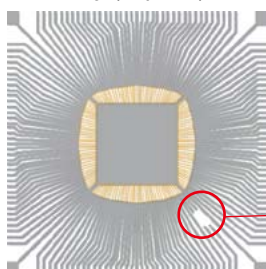
Compares the current image with a previously registered master image to extract sections that differ. It is also possible to take individual differences in non-defective workpieces into account and adjust how much differences should be recognized as defective.

INSPECTION FOR A BROKEN SECTION OF A LEAD FRAME

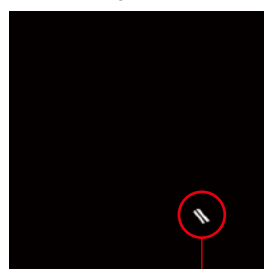
Reference image (OK product)



Current image (NG product)



Subtracted image



Only the defective section is extracted.

Only defective sections are extracted even for targets having complex shapes such as lead frames.

PRESERVE INTENSITY

Corrects changes in image brightness due to light intensity fluctuation. This filter reduces variation in measured values caused by intensity fluctuation by correcting the brightness difference from the reference image at every capture.

POSITION INSPECTION FOR SCREW MOUNTING

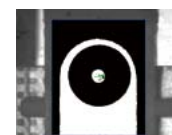
Current image (normal light)



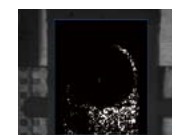
Current image (lowered light)



Even if light is lowered, the same binary conditions are preserved as with normal light.



Binary image



Binary image
Without preserve intensity



Binary image
With preserve intensity

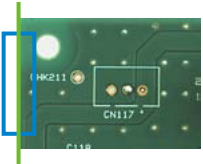
DIMENSIONS/GEOMETRY TOOL

High-precision dimension inspection can be done intuitively through simple mouse operations

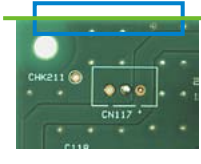
In most cases, dimension/geometric measurement for image processing requires multiple tools and complicated calculation processing. With the CV-X Series, dimensions/geometry tools can be performed with an easy point-and-click method. Points, lines, and circle information from other tools can also be referenced making it much easier to develop programs with multiple dimensions requiring inspection.

CONVENTIONAL

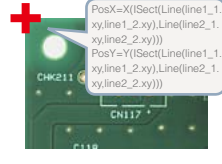
Combination of multiple settings and calculations are required



Create settings that will detect a line in the left area



Create settings that will detect a line in the top area




Calculate intersecting coordinates between 2 lines with the calculation function

```
PosX=X!(Sect(Line(line1_1.xy,line1_2.xy),Line(line2_1.xy,line2_2.xy)))
PosY=Y!(Sect(Line(line1_1.xy,line1_2.xy),Line(line2_1.xy,line2_2.xy)))
```


DIMENSIONS/GEOMETRY TOOL

Settings completed by simply clicking on the desired features




Two Lines Intersection

Select the feature to be executed, and



Just specify target lines with the mouse




DETECTED!

EASY DETECTION!
It is also possible to reference coordinates, circles, or lines from other tools that have already been created!

A vast variety of geometry tools the user can select from

Points Distance	Point/Line Distance	Line Distance	Point/Circle Distance	Line/Circle Distance	Circle Distance	Line Passing Two Points
Bisection of Two Lines	Angle Formed by Two Lines	Line/V-Line Intersection	Two Lines Intersection	Center of Quadrangle	Midpoint of Points	Circle Passing Three Points

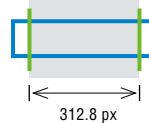
Easy scaling with any image size



Scaling


For applications where you would like actual values instead of pixels, it is possible to easily convert with the specialized scaling utility.

1 Measure the target (Can select width or pitch)

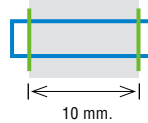


312.8 px

2 Input the actual values for the inspection region



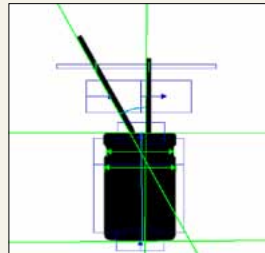
3 Convert to actual values and display



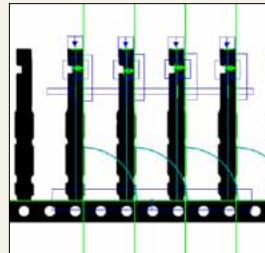
10 mm.
0.39"

APPLICATION


Even objects with complex shapes such as below can be measured quite easily.



CAPACITOR



PRESS PARTS



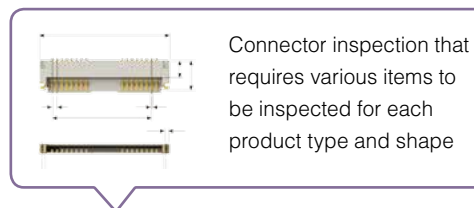
LABEL

CONNECTOR TOOLS

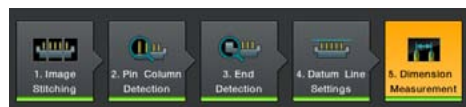
Complex connector inspection settings can be completed by simply following guided steps

Conventionally, inspection setting for connectors with various items and points to be measured require a significant amount of man-hours. With the CV-X connector tools, this can be done by any user by simply following the guided steps.

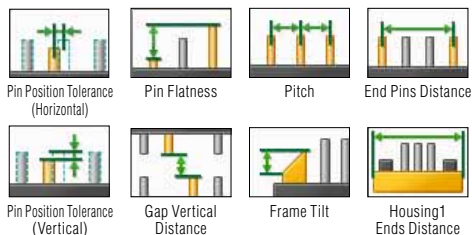
Our step method enables ANY USER to carry out connector inspection EASILY



Can be completed just by following steps specific to connector inspection



All you have to do for dimension measurement is to select from various pre-defined connector inspection tools

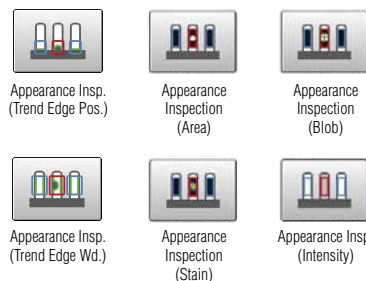


SETTING COMPLETED!



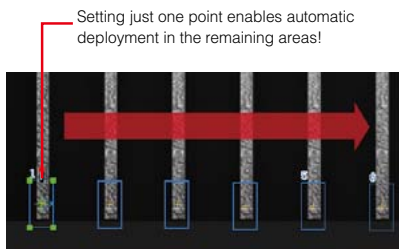
INSPECTION TOOLS THAT FULLY SUPPORT APPEARANCE INSPECTION

Existing tools can be incorporated into appearance inspection for resin overlaps, short shots, and flaws on housings. Connector inspection is fully supported with KEYENCE's accumulated appearance inspection expertise for image processing.



CONNECTOR APPEARANCE INSPECTION

Stain, Blob, Area, Intensity, Trend Edge Position, and Trend Edge Width tools are "multi-region" compatible, which enables simultaneous deployment in multiple areas. This significantly reduces setting and adjustment man-hours required for connector-specific multi-point inspection.



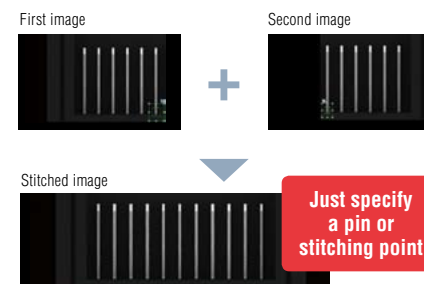
CONNECTOR ADJUSTMENT MENU



Purpose-specific, guided navigation is available, including "Change Component" and "Change Pin Number". This allows anyone to make necessary modifications like adapting a program to a similar product type with a different number of pins.

IMAGE STITCHING FUNCTION

Multiple split-captured images can easily be stitched into one image.



CONNECTOR-DEDICATED OPERATION SCREEN



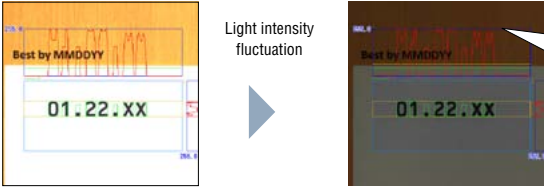
The operation screen most suitable for the connector inspection can be created just by selecting from the catalog.

OCR

Stable and reliable character recognition tool that displays extracted conditions and stability


This tool recognizes characters printed or stamped on a product. To cope with printing conditions constantly changing on site, KEYENCE has put utmost emphasis on visualizing important factors for character recognition such as character extraction, stability and character library.

Light intensity fluctuation-resistant



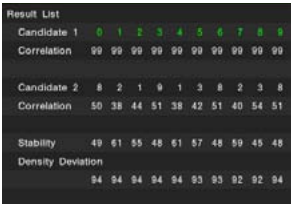
By using gray-scale processing, as opposed to binary processing, inspection is ensured even if the ambient light varies. In addition, the character extraction method is used so that the user can understand recognition conditions easily.

VISUALIZATION WITH WAVEFORMS




"Character extraction", the most important factor for character inspection, is now visualized with waveforms. The user can determine "stability" instantaneously since these waveforms can also be checked during operation.

Stability visible with numeric values



"Correlation," showing the matching percentage compared to a registered character, and "Stability," showing the margin in correlation compared to the most similar character, are checked for each character.

Flexible user library



Actual printed characters are registered within the library as they appear. Stable recognition is ensured with sub-pattern registration even if print quality varies.

1D/2D CODE READERS

Executes reading and image processing inspection simultaneously

Reads the 1D/2D codes printed on the target workpieces. Since code reading and inspection using another image processing tool can be done simultaneously, this function leads to space saving and cost reduction compared with conventional cases where 1D/2D code readers and image processor are installed separately.

1D CODE



2D CODES



DataMatrix QR code



Within the same workpiece, appearance inspection is performed simultaneously with reading of the 2D code.

PRINT QUALITY VERIFICATION FUNCTION (2D CODES)

This newly added function to verify 2D code printing quality enables in-line checking of relative changes in printing quality while simultaneously reading. Complies with ISO/IEC 15415, AIM DPM-1-2006, and SAE AS9132.

Notice: This function is designed to capture relative changes in print quality and thus cannot be used as a print quality verification system for absolute value evaluation.

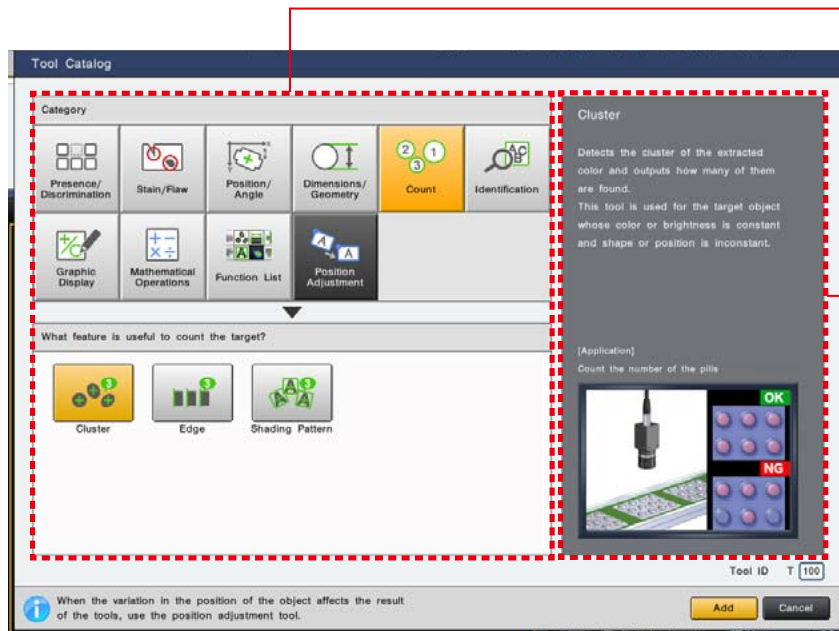
... > Overall Symbol Grade Condition

Select All Deselect All

- ☒ Decode(DEC)
- ☒ Symbol Contrast(SC)
- ☒ Modulation(MOD)
- ☒ Reflectance Margin(RM)
- ☒ Fixed Pattern Damage(FPD)
- ☒ Axial Nonuniformity(AN)
- ☒ Grid Nonuniformity(GN)
- ☒ Unused Error Correction(UEC)
- ☒ Format Information Damage(FID)
- ☒ Version Information Damage(VID)
- ☐ Print Growth Horizontal(PGH)
- ☐ Print Growth Vertical(PGV)

TOOL SELECTION CATALOG BASED ON APPLICATION

Just select the desired application type, instead of the traditional tool name



TOOL CATALOG

The tools have been categorized according to application, based on common industry inspection applications. It allows the user to intuitively find the best tool for their application.

APPLICATION NAVIGATOR

A description and typical application for each tool is displayed for optimal selection of the correct inspection type.

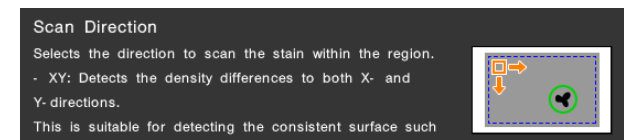


INTUITIVE MENU ORGANIZATION

The setting menus are arranged so that they are very graphical and easy to understand in order to help guide the user through the proper setup of each tool.

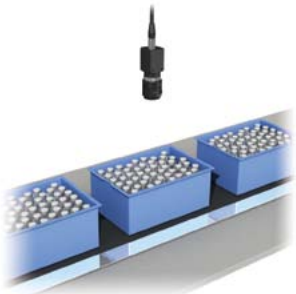
HELP GUIDE FUNCTION

A help guide is incorporated that includes a description of the parameter that is being adjusted for a clear understanding of what is being changed.



APPLICATION

When setting to count the expected number of workpieces in a case...




Conventional

Inspection is difficult to setup as the user cannot reliably determine which algorithm is the best choice.

Tool catalog

Just select the inspection category from the tool catalog

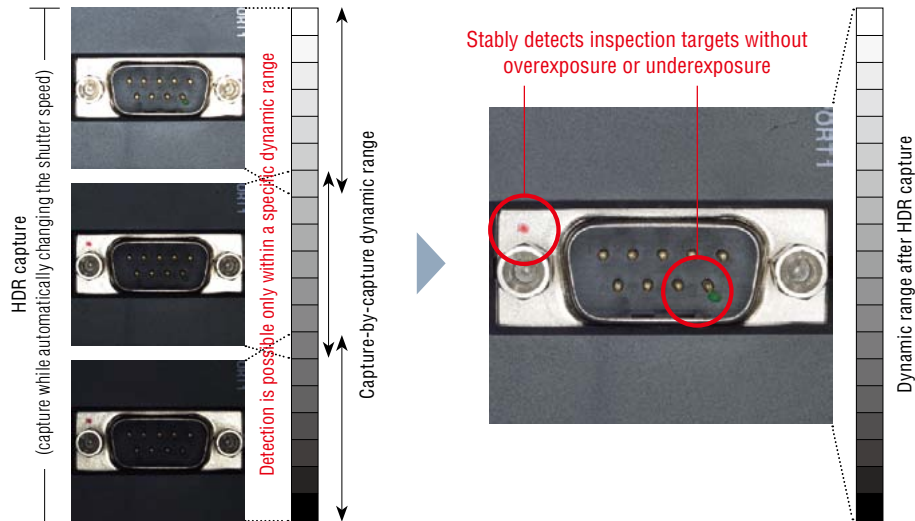
Counting tools are outlined in the "Count" category so there is no confusion.



HDR

High dynamic range captures quality images on difficult targets

Captures multiple images while automatically changing the shutter speed and combines them at high speed to generate images without overexposure or underexposure. Images ideal for processing can be captured even when on-site capture conditions vary or inspection targets contain uneven glossiness or mixed intensities.



Glare removal

Stable capture results can be obtained even for targets with a high reflectance such as metal workpieces.



Lighting variation removal

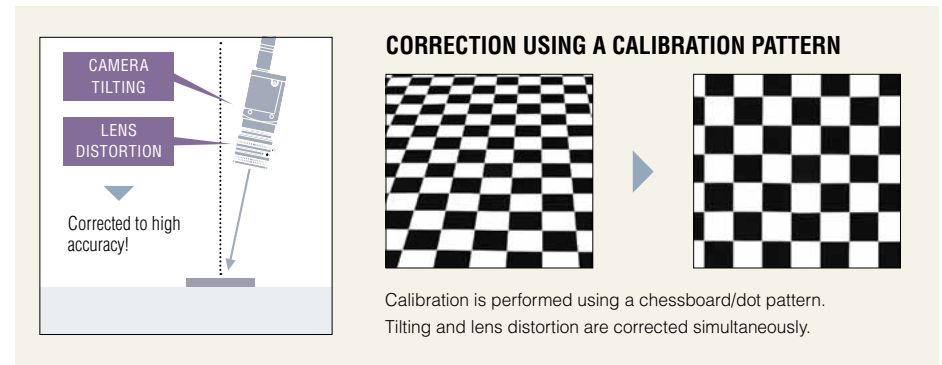
Effective also when lighting conditions vary depending on the workpiece shape.



CALIBRATION

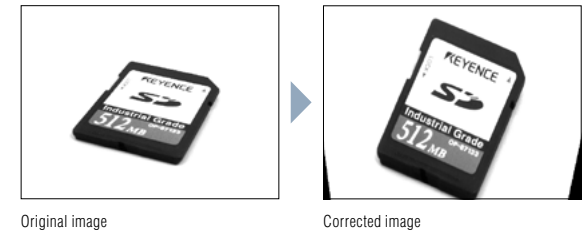
Removes effects of lens distortion or camera tilting

Removes effects due to installation and hardware related factors such as camera tilting and lens distortion. This function offers consistent capture conditions.



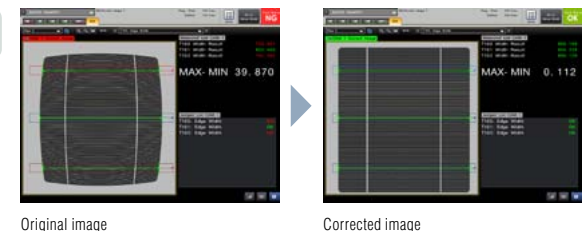
Corrects tilting

Corrects camera tilting that may occur during installation. This is also effective when a camera is installed at an angle due to installation space restrictions.



Corrects lens distortion

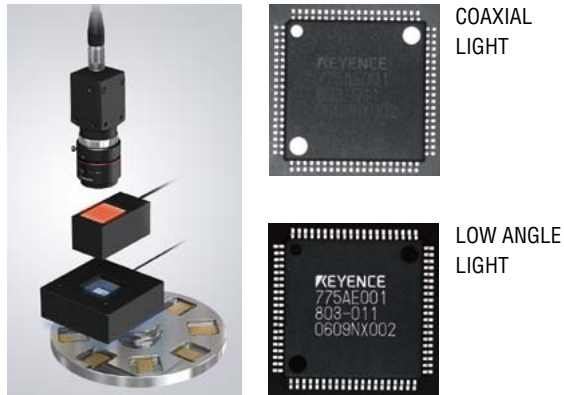
Addresses the problem where measurement results differ between image center and edge due to lens distortion.



MULTI-CAPTURE

Optimizes one inspection cycle

Multiple images can be captured under different lighting conditions, allowing processing and outputting results from all images in one inspection cycle.



Lighting is switched to optimize illumination for each inspection item, including direction marks, prints, and leads.

CONVENTIONAL

To switch between two types of lighting, the "capture -> inspect -> output" cycle had to be performed twice. Two triggers had to be input and two outputs also had to be handled by an external PLC.

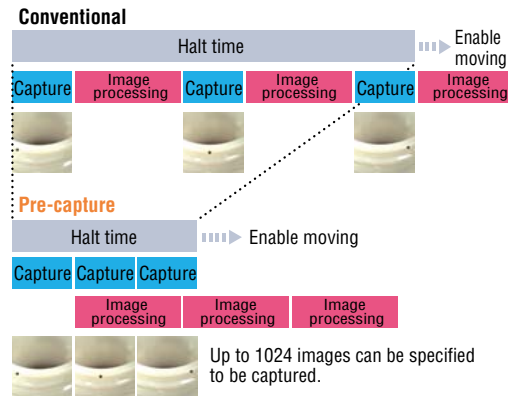
MULTI-CAPTURE

Images under two types of lighting can be captured with one trigger. This means there is only one output for each workpiece.

PRE-CAPTURE

Parallel inspection during capture at top speed

Image capture is performed at top speed simultaneously storing the image inside the device and concurrently executing image processing. No restriction will be imposed on the halt time or moving speed regarding the object, therefore the designed maximum performance can be exerted.



Even for a workpiece rotating at high speed, images are captured at top speed for the entire circumference, after which the pre-captured images are inspected collectively when the workpiece is fed.

CONVENTIONAL

Since repetition of "capture -> inspect -> output" required a longer time for one cycle of inspection, the workpiece rotation speed had to be lowered for inspection. As a result, the performance of the whole equipment was lowered.

PRE-CAPTURE

Since a workpiece can be captured repeatedly at top speed even while rotating, inspection is possible without increasing the processing time. Performance can be improved further by combining with a high-speed camera.

RANDOM TRIGGER

Capture according to equipment movement

Random trigger is supported, and makes it possible to input triggers without synchronization with the process currently being executed. There is no reliance on current image processing conditions, and it is possible to perform image capture that matches equipment movement.



Since triggers can be input at any timing according to transfer system movement, equipment cycle time can be improved dramatically.

CONVENTIONAL

The index stopping time had to be extended to align timing or two controller units had to be used.

RANDOM TRIGGER

Because there is no latency for image processing, operation without stopping the equipment is possible even with a single controller.

UTILITIES

Easy-to-use utilities applying professional knowledge from on-site experiences.

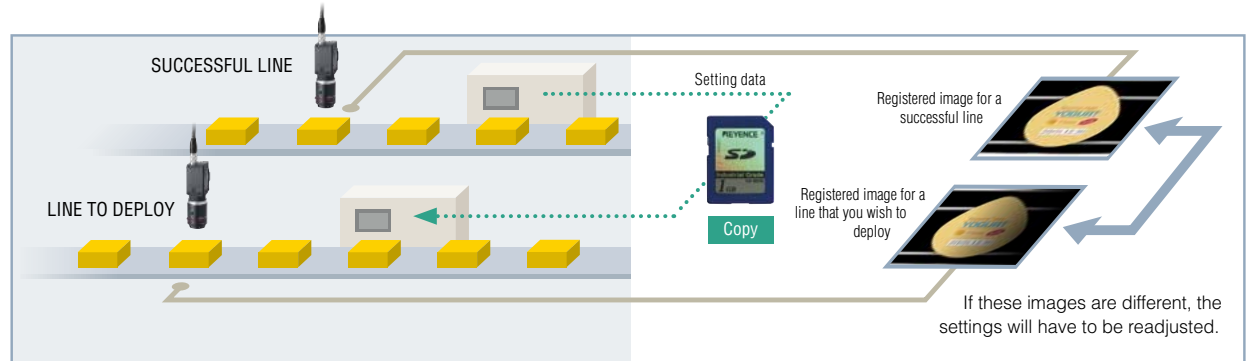
There are many useful utilities for various situations, such as duplicating an inspection environment on another line, making adjustments due to many false detections and managing the inspection process in real time.

Navigation that always guarantees a consistent image capture environment without relying on location.

Camera Installation Replication

CONVENTIONAL

The production line has been extended, so I would like to expand the inspection environment without making changes. The setting data is copiable. If I could have replicated just the same camera installation, I wouldn't have to readjust or start the settings all over again.



CAMERA INSTALLATION REPLICATION

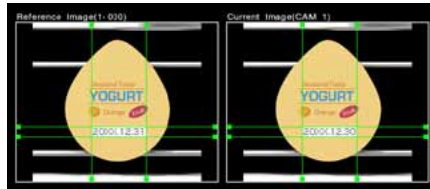
THE CAMERA INSTALLATION CONDITIONS OF THE NEIGHBORING SUCCESSFUL LINE ARE REPLICATED

The current image can be matched with the same capture conditions as those of the reference image. This is useful for:

1. Matching an image for a line to deploy with the reference image from a successful line.
2. Making a comparison with the reference image at the point in time when the settings were created to check "if the conditions are still the same".

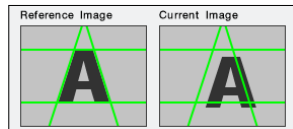


POSITION ADJUSTMENT TOOL



Successful line

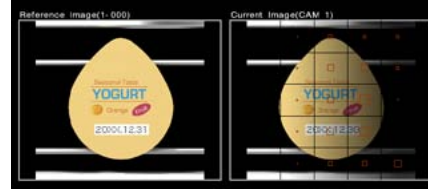
Line to deploy



Draws grid lines in featured areas of the reference image. The position of the camera is adjusted using the grid lines on the current image side that is moving in tandem as a guideline.



BRIGHTNESS ADJUSTMENT TOOL



Successful line

Line to deploy

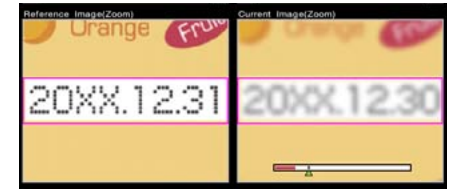
Shows areas with different brightness from the reference image in color so that you can adjust them to reduce the difference.

■ Brighter than reference image

■ Darker than reference image

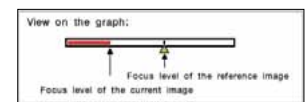


FOCUS TOOL



Successful line

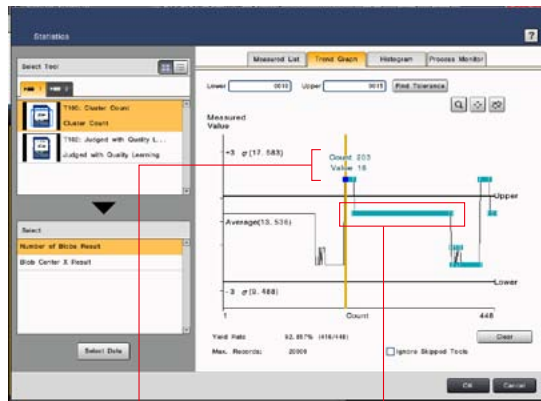
Line to deploy



A comparison with the focal condition of the reference image is displayed in a bar graph. The focus of the lens is adjusted to match the level of focus for the reference image.

Managing the inspection process with Statistics

Up to 20,000 pieces of measurement data can be recorded directly on the controller. It is possible to easily check the values such as minimum, maximum, average, standard deviation, NG count, and yield rate. In addition to the trend graphs, a list of measured values and a histogram can be displayed. Also, by using the newly-included function, Process Monitor (process capability index: Cpk), it is possible to analyze the inspection processes more statistically.

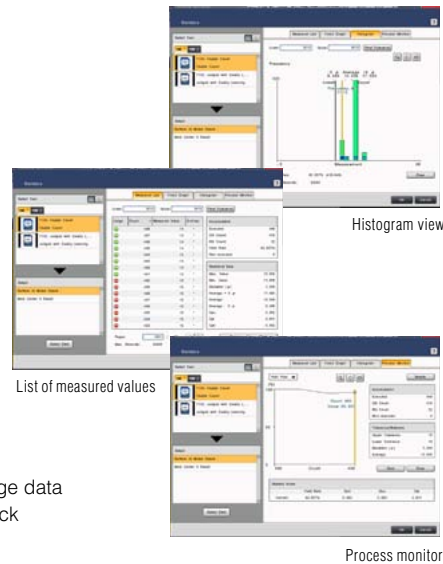


VERTICAL CURSOR

Displays the measured values and the total count for the selected cursor position.

IMAGE SAVE MARK

■ marked data has its image data saved. It is possible to check images by clicking.



Archived image/image output

Every single image can be saved within the main buffer capacity range. It is also possible to output images externally (to SD card, PC program, or FTP server) while saving to the main buffer.



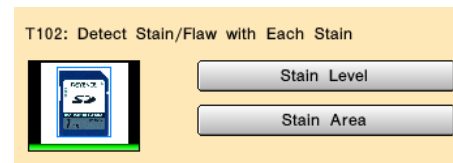
Maximum number of images* that can be saved, organized by connected camera

Camera type	Number of images saved to the internal memory		Number of images saved to the 4 GB SD card
	CV-X292	CV-X172	
Monochrome 0.24M pixel	1024	1001	16284
Color 0.24M pixel	1024	992	5490
Monochrome 0.31M pixel	1024	489	13071
Color 0.31M pixel	1024	484	4396
Monochrome 2M pixel	784	105	2114
Color 2M pixel	768	97	706
Monochrome 5M pixel	288	35	816
Color 5M pixel	276	27	272
Monochrome 21M pixel	55	—	193
Color 21M pixel	45	—	64

* The values for the internal memory are typical values when a single camera is connected using CV-X292 or CV-X172 and when storage conditions for archived images have been "total status NG". Those for the 4 GB SD card are typical values when a single camera is connected.

Tolerance overwrite function

Judgment conditions and stain levels can be rewritten during operation. This enables you to adjust tolerance easily even where the production line cannot be stopped.



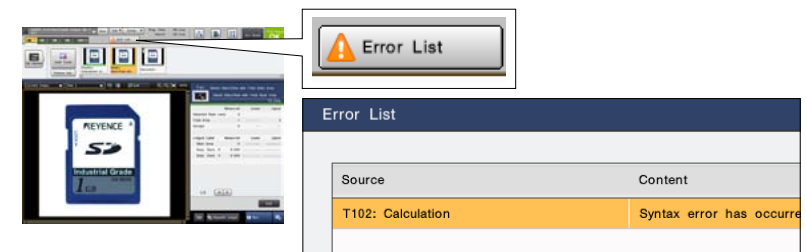
Shared judgment function

Judgment conditions can be shared between similar tools. This function is useful when the same inspection processing is required on multiple points on the screen because a change made to one point is automatically reflected onto the others.



Error notification

Displays setting errors in a list. It is also possible to select the error from the list screen and jump directly to the corresponding area.

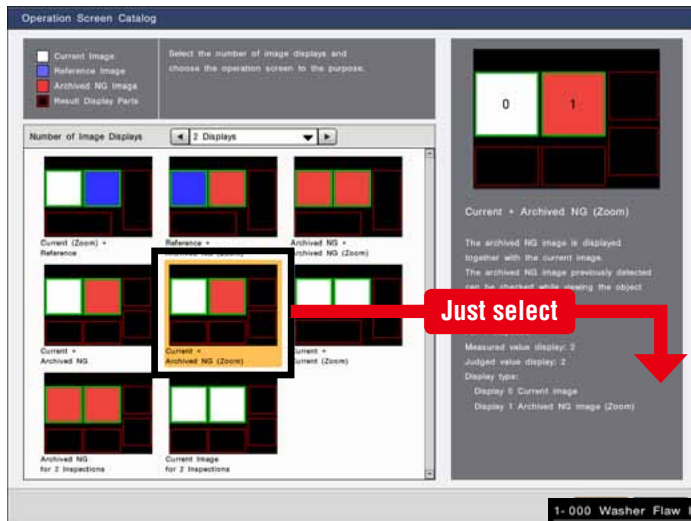


USER INTERFACE

No complicated customization is required. Just select a template

To greatly simplify the customization of operation screens and improve visualization of the process, an operation screen catalog function is incorporated along with many custom functions.

Just select the best screen from the Operator Screen Catalog



Point

- Parameters, whose tolerances have been set, are automatically added to a list that displays judged and measured values.
- Even when tools are added later, additions to the display are performed in conjunction.
- Units set with scaling are automatically displayed.

Just selecting the number of display screens you wish to have will show a selection of screen layouts for various situations in catalog format.

JUST SELECT THE SCREEN LAYOUT FOR THE SITUATION

- To display the current image with the latest NG image side by side.
- To show images from multiple cameras on a single display.
- To automatically zoom in the NG-judged area.
- To display an image side-by-side with the reference image at initial setting so that changes from the start can be checked.



INTUITIVE OPERATION WHEN CREATING SETTINGS

TOOL BAR DISPLAYING THUMBNAIL PREVIEWS

Added tools are displayed in thumbnails. Because the inspection region is displayed in a thumbnail, it becomes easy to understand which part is being inspected.



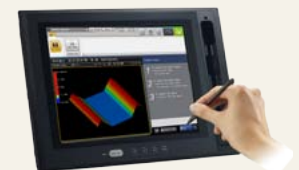
INTUITIVE OPERATION WITH A MOUSE

The icon-based, easy-to-understand GUI enables intuitive operation with a mouse. In addition, the region can be manipulated on the display directly with a mouse during setting.



TOUCH PANEL SUPPORT NEW (CV-X200 Series only)

A touch panel can now be connected so that you can enhance on-site efficiency. This ensures easy operation even where a mouse is not available. Program adjustment efficiency can be improved further through combination with a custom menu.

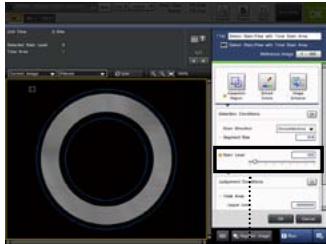


* Microsoft is a registered trademark of Microsoft Corporation in the United States and other countries.

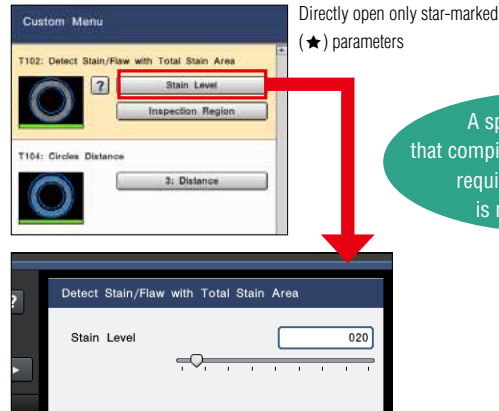
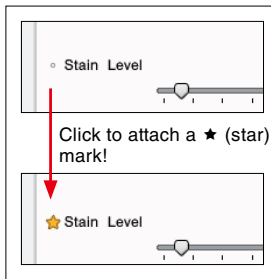
A Custom Menu function that realizes the optimal operation with a single click

During operation, some parameters are adjusted often, and some are kept hidden to prevent misoperation. When using the custom menu function, the optimal operator menu can be created just by placing a "★" on parameters that are often adjusted.

JUST MARK THE PARAMETERS WHEN PERFORMING SETTINGS...



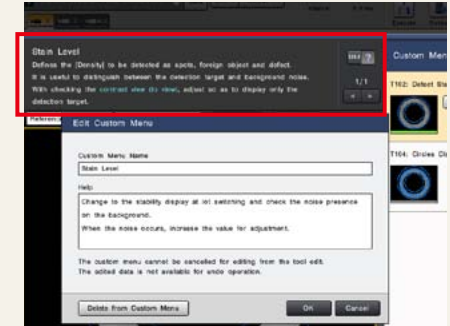
When it seems that these parameters are adjusted often...



Directly open only star-marked (★) parameters

A specialized menu that compiles setting parameters required for operation is now complete!

OPERATION COMMENT FUNCTION INCLUDED

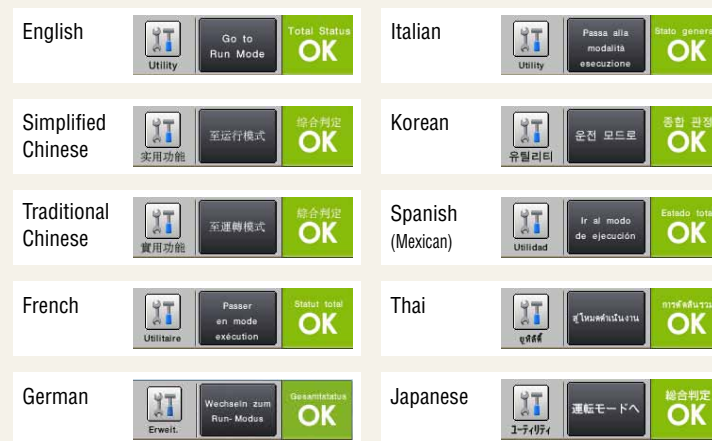


The operation comment can be displayed on the help field. The display of information that is necessary to set the timing, situation, and guidelines can be input.

TEN LANGUAGES SUPPORTED

In addition to conventional display language switching, the character input function also supports multiple languages. It is possible to perform direct input for each language with things such as the tool names or the custom menu comment function and operation screen display character strings without switching the language for the system itself.

MULTI-LANGUAGE INPUT SYSTEM INCORPORATED



THE CHARACTER STRING INPUT ON THE CONTROLLER ALSO SUPPORTS MULTIPLE LANGUAGES



A soft keyboard that supports multiple languages is displayed during entry.



USER MANUAL AUTO-GENERATOR/PC SOFTWARE

PC software that strongly supports operation

The User Manual Auto-Generator function, PC Simulator function and the ability to collect image and measurement data are all included with the free PC software.

CUSTOMIZED USER MANUAL ENSURES OPTIMAL OPERATION FOR ALL USERS

CONVENTIONAL

An operation manual is required as reference material for a customer that has had the equipment installed...



I want to have on-site operators refer to the manual but I want to summarize only the functions I need.



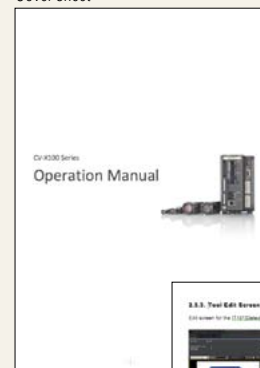
USER MANUAL AUTO-GENERATOR

CUSTOMIZED MANUAL CREATION IN A SINGLE CLICK!

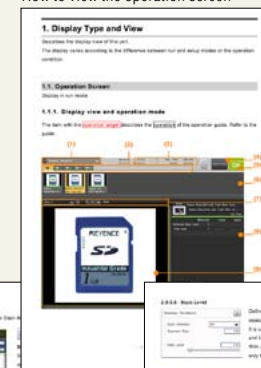


EXAMPLE OF CREATED MANUAL CONTENTS

Cover sheet



How to view the operation screen



A list of tools



Basic tool settings



An explanation of the main parameters

MULTIPLE LANGUAGE SUPPORT

User manuals can be created in ten languages according to the languages of setting files.

TOOL SETTING TIPS

It is possible to insert Tips describing how each tool's parameter is typically adjusted.

MS WORD OUTPUT

Outputs in Microsoft Word format. It is possible to freely delete unnecessary parts, and add comments.

TIME SAVING

Many man-hours are saved when creating a customized user manual for the inspection.

REPRODUCES THE SAME CONDITIONS ON A PC AS ON SITE: PC SIMULATOR FUNCTION

CONVENTIONAL

I cannot stop my production line for a long time although I want to make adjustments on site



According to changes in manufactured items, I need to add settings, but the site is remote



PC SIMULATOR



Download the setting file, including both the OK and NG images, from the controller running on site.



Using simulation software installed on a PC, setting creation and verification using images can be performed even at a remote site just as on an on-site machine.



APPLICATION SAMPLE

Exchange e-mail with a setting operator at a remote site

MANUFACTURING SITE



Acquire setting and image files from the controller

SETTING OPERATOR

Correct settings using simulation software



Exchange files via e-mail or the Internet

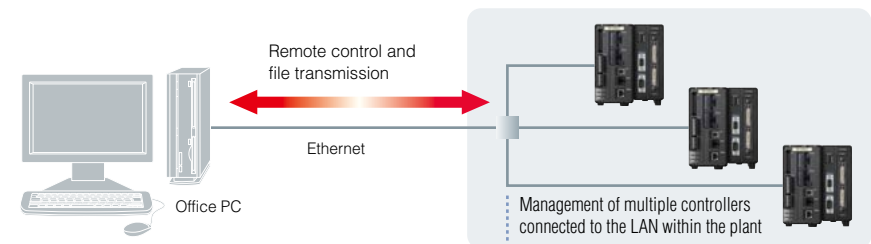
MANUFACTURING SITE



Transfer corrected setting files to the controller

Acquire image files and measurement data into a PC and operate controllers remotely: Data Logging & Remote Desktop Function

Images and measurement results from a connected controller can be acquired into a PC. Using the remote desktop function, maintenance man-hours can be reduced significantly since tasks that require travel to on-site locations can be accomplished remotely, including setting change for a controller at another plant.



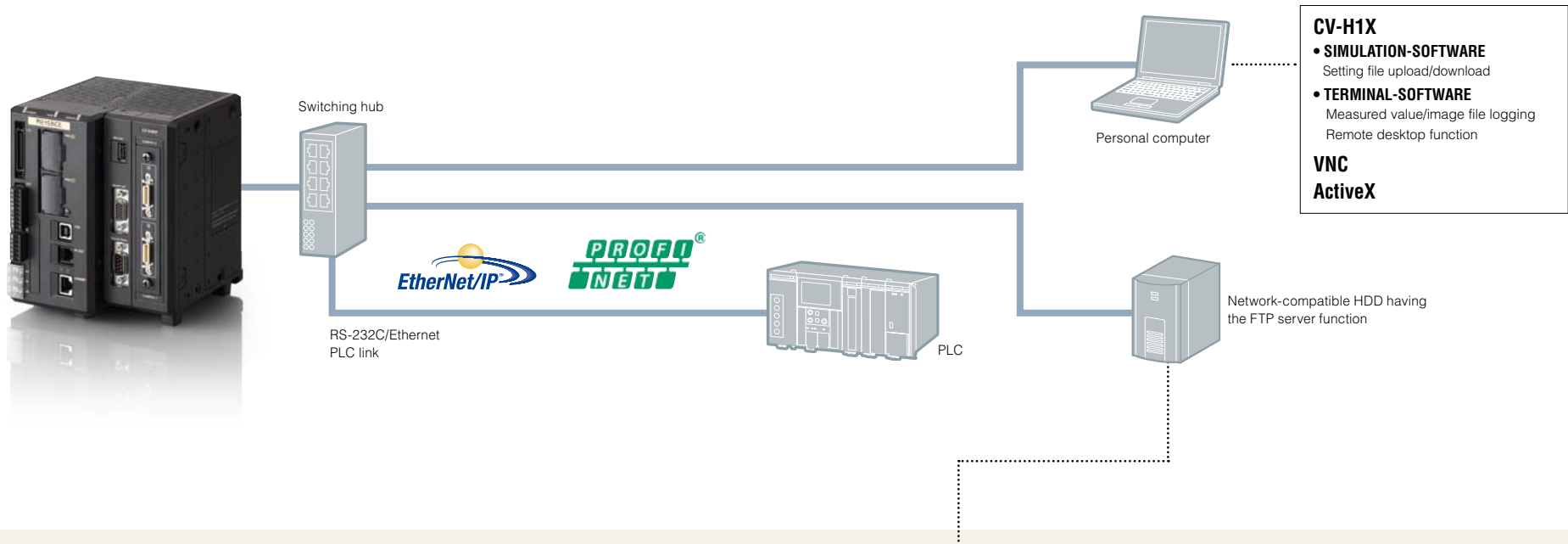
COMMUNICATION AND CONTROL

A wide variety of communication methods compatible with existing systems

A wide variety of communication methods are available to satisfy communication control needs, including logging of images and data, PLC control of the vision system through commands, and various display and monitor functions are available to improve operation and security. Various monitor functions useful at start up and other times are also available to improve operability and security.

COMMUNICATION INTERFACE

Supports linking to PLCs made by several manufacturers as well as EtherNet/IP and PROFINET, which enables easy integration into an existing system. In addition, remote control via connection to a personal computer and image/result logging to an FTP server are also available.



PLC LINK

PLCs made by several manufacturers can be linked via RS-232C/Ethernet.

SUPPORTED PLC MANUFACTURERS:

- KEYENCE: KV Series
- Omron: SYSMAC Series
- Mitsubishi Electric: MELSEC Series
- YASKAWA Electric: MP Series

EtherNet/IP- and PROFINET- compatible



SMART MONITOR FUNCTION

The equipped monitor function checks communication separately for EtherNet/IP and PROFINET so that you can detect problems quickly.

FTP OUTPUT FUNCTION

Supports image/measured value output to an FTP server. Images can be saved for a long period of time by connecting a high-capacity HDD having the FTP server function.



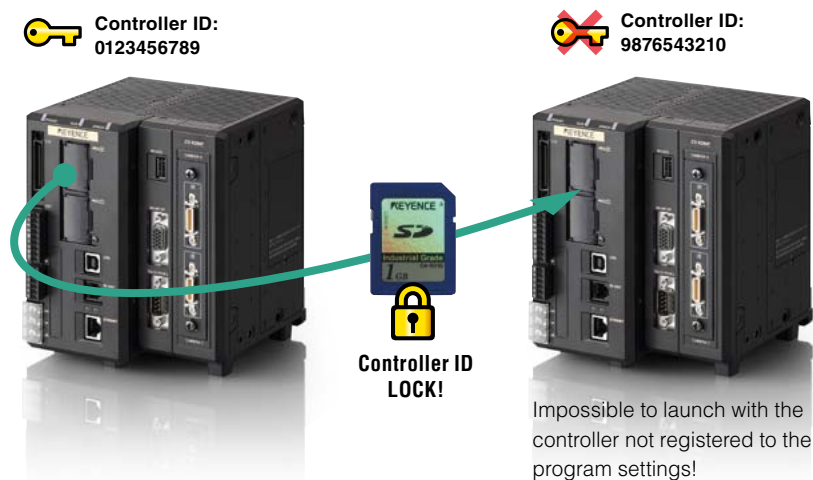
SECURITY/ACCOUNT

Robust security that protects program assets

For image sensor operation, it is important that the setting contents are easy to understand and can be easily accessed. On the other hand, there is an extremely strong need not to disclose program contents and prevent the copying of setting files. With the CV-X Series, robust security functions that answer these demands have been prepared and separated by purpose.

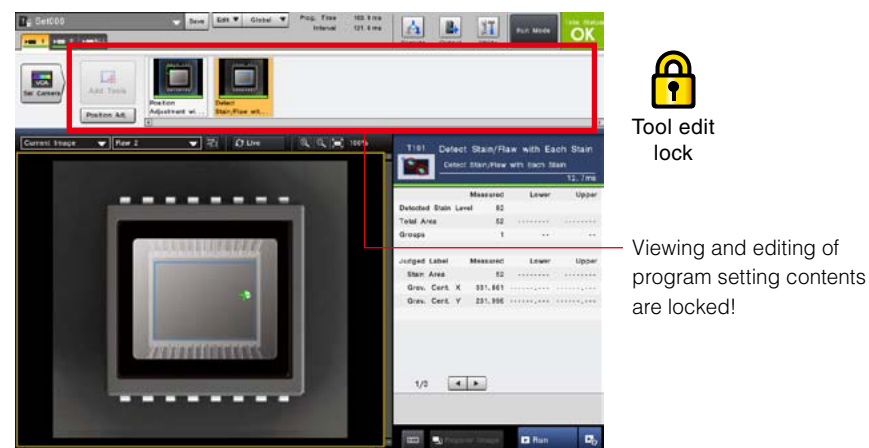
CONTROLLER ID LOCK

This is a function that does not start program settings with controllers other than those that have the specified unique ID (controller ID). This is useful in protecting against the copying of program assets and unintended controller operation.



TOOL EDIT LOCK

If a tool edit lock is applied, browsing or editing program setting contents will no longer be possible. This prevents the external outflow of programming knowledge, such as the parameter values or pre-processing filters used.



Tool edit lock

Viewing and editing of program setting contents are locked!

PASSWORD SETTINGS

The entry of up to 32 characters is supported for the password. This feature meets demands for more secure password management.



ACCOUNT SETTINGS

OPERATING SETTING PROTECTION

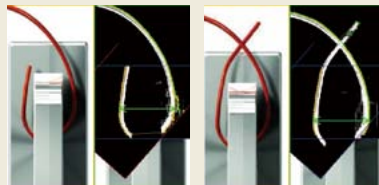
For a smooth operation after introduction, 3 types of accounts are provided. Using an account that is managed with a password prevents operation mistake and unnecessary setting changes.

ADMIN	All operations are possible.
OPERATOR	Custom menu operation, change program, and saving are possible.
USER	Only viewing operations are possible.

Password setting for the purpose of changing accounts is possible.

Presence/Discrimination

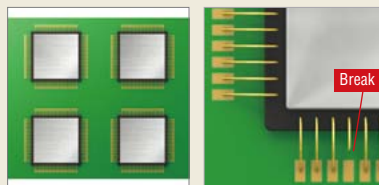
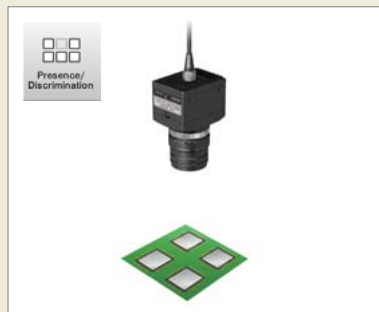
Winding defect inspection for motor wire



OK product

NG product

Wire bonding inspection

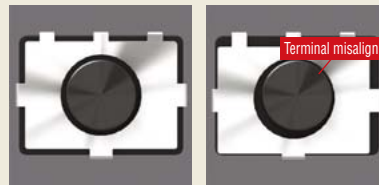


Full image

Magnified image

Position/Angle

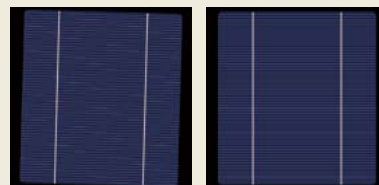
Positioning inspection for switch terminal



OK product

NG product

Solar cell alignment

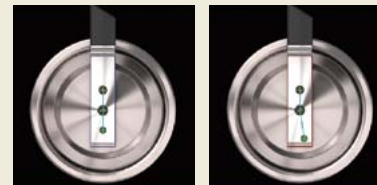


Before alignment

After alignment

Dimensions/Geometry

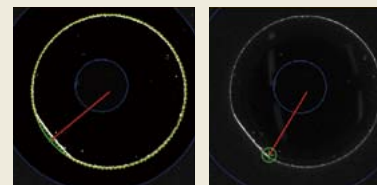
Welding position defect inspection for battery tab terminals



OK product

NG product

D-cut rotation angle measurement for lens

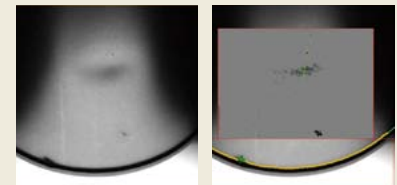


Trend edge stain

Conventional method

Stain/Flaw

Appearance inspection for battery outer cans

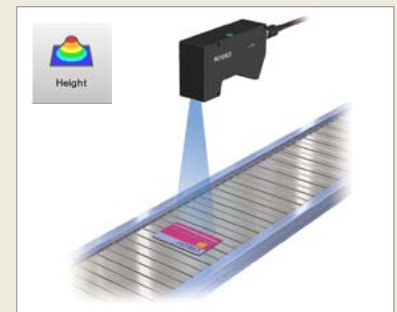


Raw image

Processed image

3D

Credit card print reading

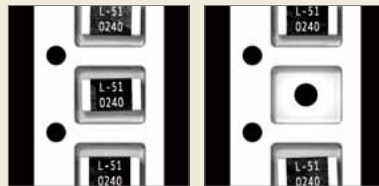


3D image

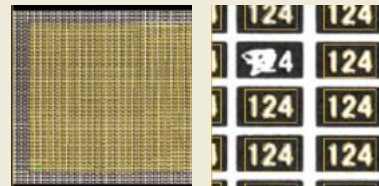
Processed image

Presence/Discrimination

IC presence inspection on carrier tape

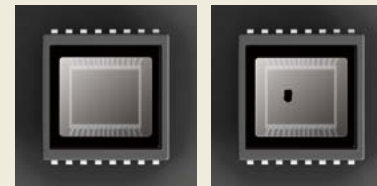


Count & print defect inspection for microchips



Stain/Flaw

CCD stain inspection



Position/Angle

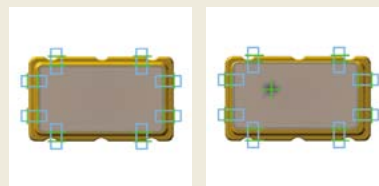
Defective lead inspection for capacitor



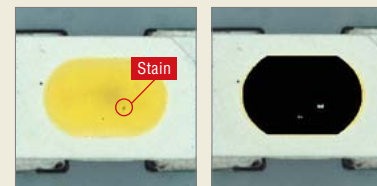
Marking density inspection for capacitor



Appearance inspection for crystal oscillator

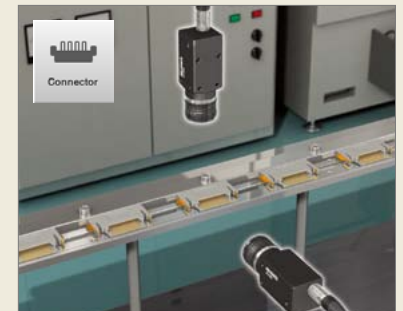


LED appearance inspection



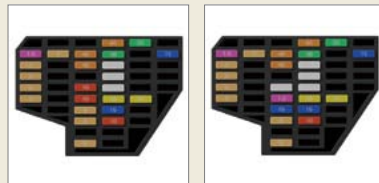
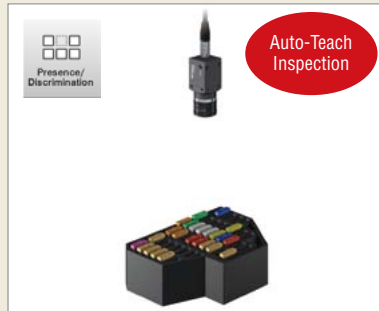
Connector

Connector coplanarity inspection



Presence/Discrimination

False assembly inspection for fuse boxes



OK product

NG product

Detection of grease application amount



OK product

NG product

Position/Angle

Performance inspection for speedometer

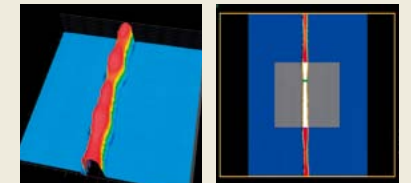


OK product

NG product

3D

Width and volume measurement for sealer application



3D image

Processed image

Stain/Flaw

Type discrimination for wheels



OK product

Different type

Cutting chip adhesion inspection for pistons



OK product

NG product

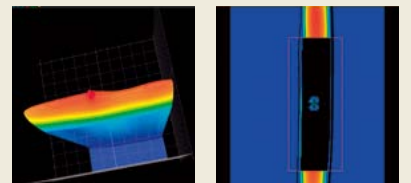
Positioning detection for O-rings



OK product

NG product

Dent shape inspection for rubber coated wire

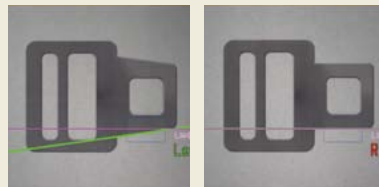


3D image

NG product

Presence/Discrimination

Type differentiation for seat belt buckles



OK product

NG product

Stain/Flaw

Appearance inspection for bearings



NG product

Magnified image

Stain/Flaw inspection for steel plates

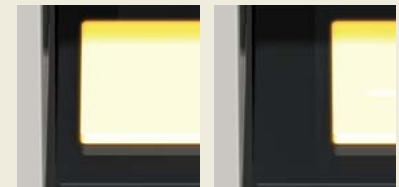


NG product

Image after filtering

Position/Angle

Position check for workpiece in die



OK product

NG product (workpiece displaced)

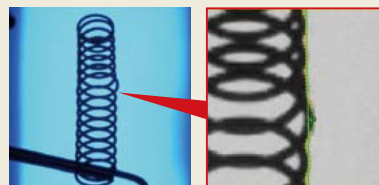
Burr inspection for washers



OK product

NG product

Appearance shape inspection for springs



NG product

Magnified image

Appearance inspection for forging

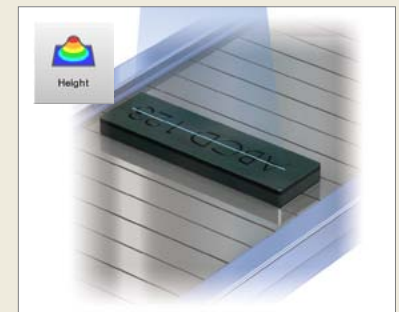


Raw image

Shading-corrected image

3D

Stamp inspection for metal



3D image

3D image

Presence/Discrimination

Presence inspection for instant noodle ingredients

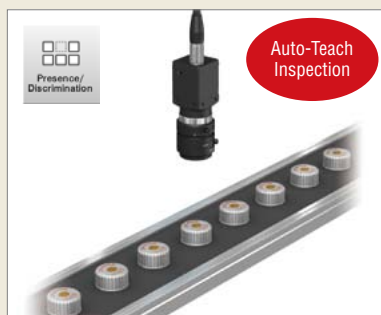


OK product



NG product

Variant mixed-in inspection for caps



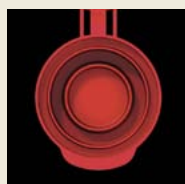
OK product



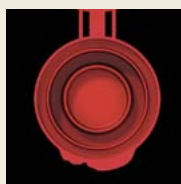
NG product

Stain/Flaw

Appearance inspection for a cap



OK product



NG product

Flaw inspection for mouth of glass bottle



OK product



NG product

Identification

Barcode reading for paper packaging



OK product



NG product

Text recognition of best before date



OK product



NG product

Position/Angle

Positioning inspection for labels



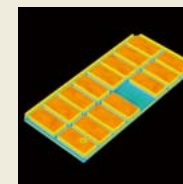
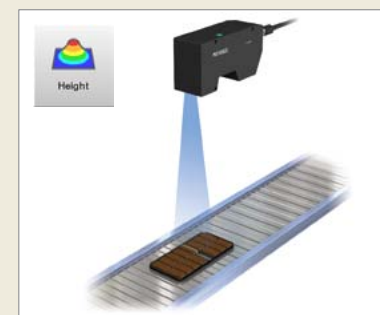
OK product



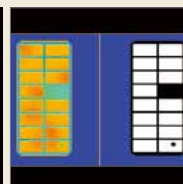
NG product

3D

Count and overlapping inspection for chocolates



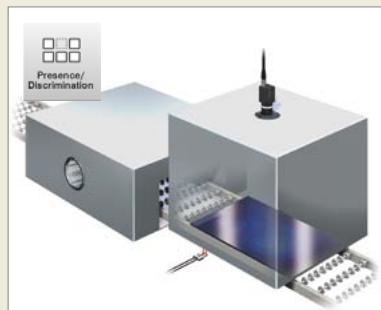
3D image



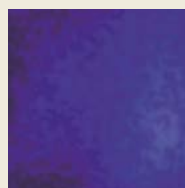
Processed image

Presence/Discrimination

Discrimination of cell color



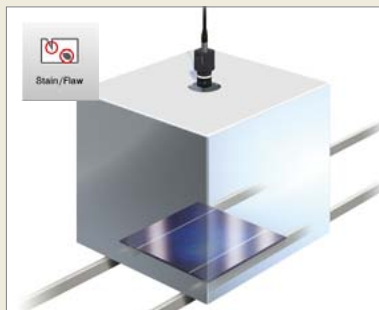
OK product



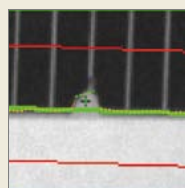
NG product

Stain/Flaw

Appearance inspection of a cell



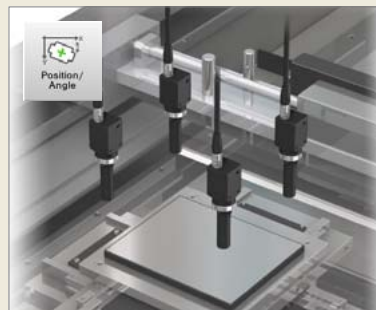
Cuts on electrode printing



Chipped edge

Position/Angle

Glass substrate alignment



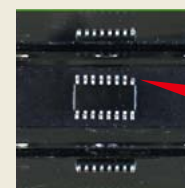
Before alignment



After alignment

Dimensions/Geometry

Bend inspection for IC leads



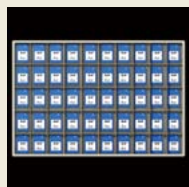
NG product



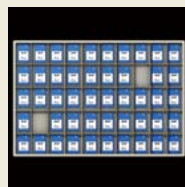
Magnified image

Count

Counting the number of SD cards

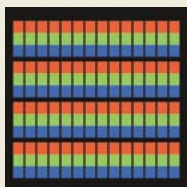


OK product

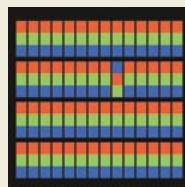


NG product

LCD panel appearance inspection



OK product

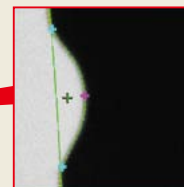


NG product

Wafer alignment



Full image



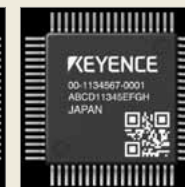
Magnified image

Identification

2D code reading on a mold

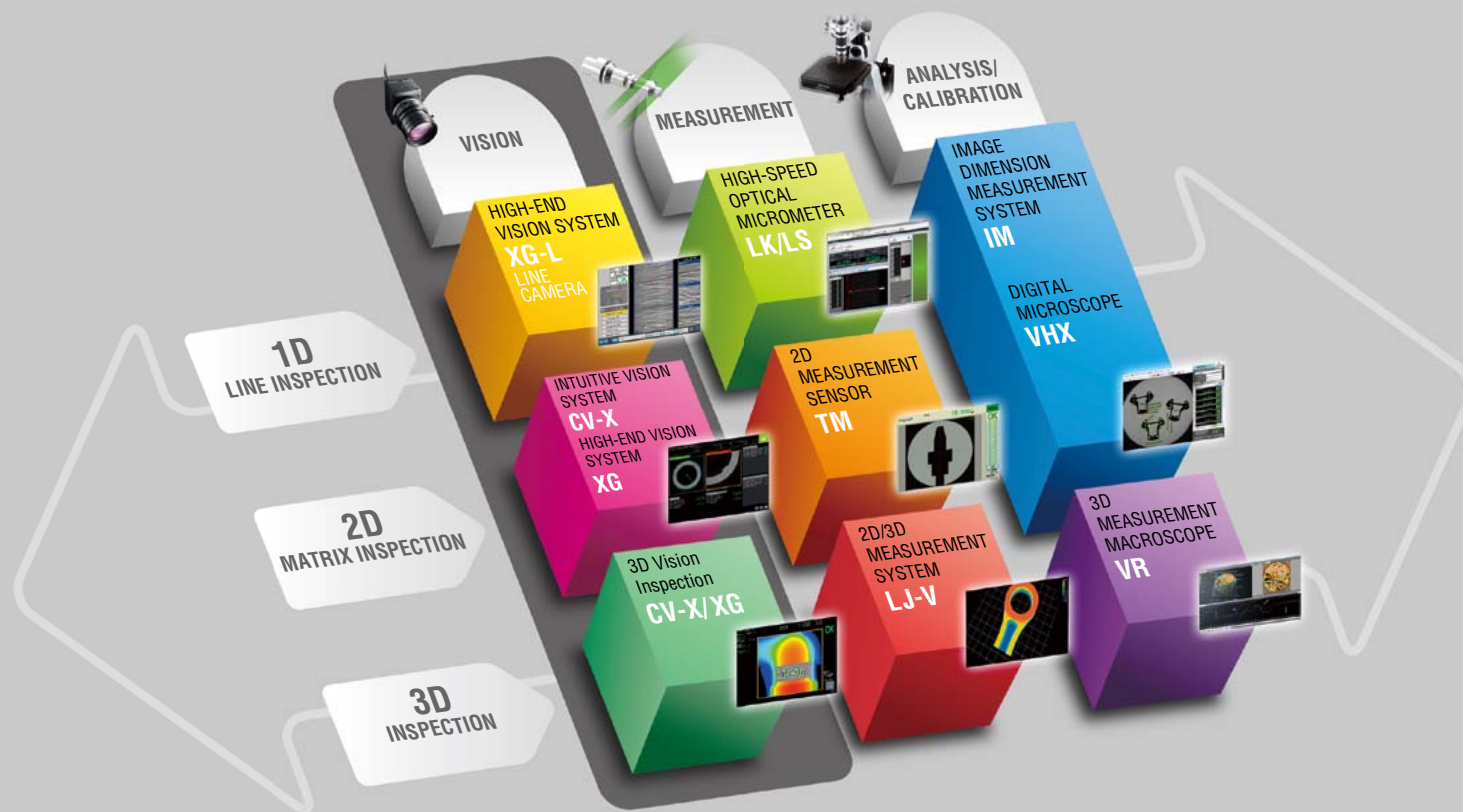


OK product



NG product

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SAFETY INFORMATION

Please read the instruction manual carefully in order to safely operate any KEYENCE product.

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